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THE INTRODUCTION, DEVELOPMENT, DESCRIPTION AND OPERATION OF MODERN ONE-BOAT PURSE SEINING IN THE PHILIPPINES[1]

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SEVEN TEXT FIGURES

ABSTRACT

This paper presents the successful introduction and development in the Philippines of the one-boat system of modern purse seining. Modus operandi, progress of development, and characteristics of the operation are described.

The term "modern purse seining" as used in this paper means the mechanized operation of a purse seine net on board a purse seiner equipped with modern facilities such as purse winch for pursing the net, power block to haul the net back into the boat, and an electronic fish detector to locate and detect fish schools. Necessarily, the purse seiner should be sturdily built, stable, and with powerful propulsion and auxiliary engines. Likewise, the purse net should be of suitable materials and heavily constructed to withstand mechanized fishing operations.

TRADITIONAL PURSE SEINING

Before the introduction of modern purse seining, Filipinos have engaged for many years in many methods of purse sein-

[1] Presented at the Indo-Pacific Fish Council Meeting, 11th and 12th Sessions.

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ing. "Talakop" is popular in the Southern Tagalog Region and Northwestern Visayas. The Pukot Panolingan of Batangas is 450 fathoms long by 25 fathoms deep and middle leadline is provided with a series of purse rings threaded through by a Manila pursing rope. It is mainly hand operated in 20 m. long dug-out bancas and the net is constructed very lightly with minimum weights on the sinker line. To hasten the closure of the leadline immediately under the boat, a tom weight averaging 80 kg. is used before starting the pursing in order to bring the leadlines deeper and closer to each other. The net is designed for day operation on schools of small tunas such as skipjacks, yaitos, and bonitos.

The "Kubkub" of Masbate and Iloilo is similar to the "pukot panolingan" of Batangas except that the former is used either on fish groups attracted to the light or on moving phosphorescent fish schools.

INTEREST IN MODERN METHODS

The interest in purse seining began with the passage of the Japanese Reparations Law under which multipurpose boats which invariably included large sardine and tuna purse seine gear were imported but most of these were not very suitable under existing Philippine conditions. Realizing the accumulation of idle fishing nets in the country imported under Reparations Law, the Philippine Fisheries Commission sought in 1962 FAO's assistance for a purse seining expert. The FAO Expert Capt. Strom ably demonstrated the modern operation of a purse seine directly to those engaged in private fishing industry.

MODERN PURSE SEINING DEVELOPMENT

In 1951, the author introduced the first mechanized purse seiner QUEEN MARY, a 19.8 m. outriggered dug-out powered by a 225 H. P. Gray Marine and provided winch for pursuing. The catching efficiency was increased five times that of the other unmechanized dug-out type of purse seiners. However, no other operators followed suit because of the high cost of maintaining and repairing the big cotton purse net.

Up to 1961, there was not a single modern purse seiner in the Philippines. However, late in 1962, Ruben Martinez of Navotas, Rizal, launched the first modern purse seiner named MELITA M.

Night fishing with lights increased catches tremendously. After months of successful fishing, the Company built two more boats in 1963, and three more in 1964. Until 1966, the Company has been the biggest and the best organized of all fishing companies engaged in purse seining.

The initial success of the first purse seiner resulted in requests to the Fisheries Commission for technical assistance which was rendered in collaboration with FAO Expert.

In May, 1964, the U.N. Special Fund Fisheries Development Project was officially launched and the experts under this project, together with the Philippine Fisheries Commission, demonstrate purse seining and render direct technical assistance to fishing boat operators as far as construction, conversion, and rigging of fishing boats are concerned.

The UNSF Project has also influenced the establishment of representative firms for imported purse seine equipment that were not available locally. These agencies greatly facilitated the importation of the badly needed equipment such as nylon nets, power blocks, purse winch, and echo-sounders.

EFFECTS ON THE INDUSTRY

Before the introduction of purse seining, the principal fishing methods were basnig and bottom trawling which accounted for 83 per cent of the annual commercial marine fish landings in 1959 to 1963. Landings by local purse seiners averaged 705 tons representing only 0.5 per cent of the total fish landed. In 1963, this increased to 3,748 tons representing 1.8 per cent of the total fish landed. In 1964, landings by purse seiners greatly increased to 9,569 tons representing 3.7 per cent of the total landings. (Fisheries Statistics of the Philippines, 1963, 1964.).

Results showed that modern purse seining increased fish production and it also affected the industry tremendously in many ways.

While more and more operators were engaged in purse seining, the increase in number of basnig and trawl boats was very slight in 1963. In 1964, many trawlers were converted to purse seiners and many basnig boats stopped operating to become fish carriers for purse seiners. It was feared that commercial basnig boats would be out of operation after

some years because they would not be able to compete economically with purse seiners which catch more and bring fresher fish to the market at competitive prices.

The effect on prices has also been felt especially during the lean months of November and December. In previous years, usually the wholesale price went as high as ₱2,000.00 per ton in Manila, but the highest registered price was only ₱1,286.00 per ton in 1964, and ₱1,000.00 per ton in 1965. (Observations from Navotas Fish Landing).

The problems of marketing fresh fish have been more keenly felt with the introduction of purse seiners. Since most purse seine operators are from the Manila area, the Manila market which is the biggest fresh market is always oversupplied during the season so that the price of fish becomes very low while fish handlers who bring fish to distant markets profit more and to the disadvantage of the fishermen themselves. The solution of the marketing problem by means of establishing more ice plants, ice storages, cold storages, and fish processing planes has been given top consideration by the Fisheries Commission.

FUTURE TRENDS

By 1964, purse seining has gained recognition as an efficient method such that more and more fishing companies are engaging in the industry. Fishing is done at night for sardines and mackerels which are easily attracted to light and are caught in large quantities. While there is no immediate danger of depletion as there are many other untapped fishing grounds, intensive fishing of known fishing grounds should be strictly regulated.

Daytime tuna fishing should be developed not only to relieve sardine and round-scad fisheries from intensive purse seining effect but also to take advantage of the rich tuna resources.

Daytime tuna purse seining has yet to be successfully demonstrated. The tuna net must be long, deep, and with heavy leadline for it to sink faster. Tuna fishing at night on fireball schools is much more effective than in daytime because schools are less mobile, surface staying, and do not sound out easily of the net.

GOVERNMENT ASSISTANCE

Technical and consultative services by the Fisheries Commission are given directly to interested parties in the form

of information, guidance and services in the preparation of project studies, supplying plans and designs for the construction of suitable vessels, supervision of the construction of new boats or the conversion of existing ones, hanging and mounting of the net, training of crew in actual fishing, and lastly, surveying and locating of new fishing grounds.

Another government incentive that generated interest of entrepreneurs is R.A. No. 3127, known as the Basic Industries Law (also known as Tax Exemption Law) which classified fishing as one of the basic industries and allowed import tax exemptions to materials and equipment not available locally. This law provides that the fishing machineries and equipment not produced locally shall be tax free until 1965, 75 per cent tax free until 1966, 50 per cent tax free until 1967, 25 per cent tax free until 1968, and 100 per cent taxed by 1969.

The Fisheries Commission has moved as early as 1965 to extend the 100 per cent tax exemption until 1970 in order to rationalize the development of the fishing industry, especially purse seining.

PROGRESS

In January, 1963, there was only one purse seiner in operation. This was followed in April of the same year of MINFISCO 3 and two months later by MINFISCO 4, both of which were very old trawl vessels converted into purse seiners under supervision of the Fisheries Commission.

In December, 1963, two newly constructed wooden vessels URICE and ELSON were launched in Navotas, Rizal. By January, 1964, one of the three new steel vessels was launched from Cebu Shipyard. By April, 1964, there were 15 vessels already commercially operating, 14 under construction and 41 in the planning stage. By November, 1964, there were 23 purse seiners in operation with a total of 2,405 GRT tonnage. By May, 1966, there were 48 in operation with a total of 4,402.79 GRT and an estimated total investment in equipment alone of about 41 million pesos (approximately US $ 11 million). (Based on 850,000 US $222,000.00) per unit, composed of catches ₱400,000.00 (U.S. $104,000.00), two carriers ₱300,000.00 (US $78,000.00), net ₱100,000.00 (US $26,000.00) and accessories ₱50,000.00 (U.S. $13,000.00).

CHARACTERISTICS OF THE OPERATION

The government directs the fishery development along the following trends:

One-boat system.—In a strong policy decision, the Fisheries Commission decided to encourage one-boat purse seining in stead of the two-boat system as the former is modern, simple, and successfully operated in most advanced fishing countries of the world.

The two-boat system was made in 1962 by a private company but failed primarily because of heavy overhead expenses.

Size of vessels.—The Fisheries Commission has considerably recommended the average size for an 24.4 m. purse seiner considering that it is sufficient for the initial development of the fishery and that bigger boats will come eventually when day fishing for tuna is better appreciated. At the end of 1964, only 43.5 per cent of the boats in operation were 24.4 m. long and the remaining 56.5 per cent were bigger vessels. Those constructed locally were within the recommendations while those converted or purchased second hand from Japan were bigger boats.

The size range of the seiners in operation is 60 to 144 tons GRT or average of 104.6 GRT.

TYPES OF VESSELS AND EQUIPMENT

One-masted.—This type includes all locally constructed purse seiners and converted trawlers. It has the pilot house and engine room well forward leaving a spacious aft for the net platform and working deck. Immediately aft the pilot and the engine house is the mast and boom. The hatch coamings are located right on the working deck aft of the mast while the purse davit is in line with the position of the purse winch.

This is also called the Marco type. It has the advantage of having all the net done aft of the pilot house. This type including the locally constructed vessels represents 35.5 per cent of the total number of vessels in operation.

Two masted.—This type of purse seiner includes all Reparations vessels and imported second hand Japanese purse seiners representing 64.5 per cent of the purse seiners in operation. It has a central or more aft pilot and engine house leaving enough

space aft for the net platform and a mast and boom for the power block. A separate sampson or kingpost and mast and boom for ring lifting and fish brailing are located forward of the pilot house while the purse davit is in line with the position of the purse winch.

Converted vessels.—The conversion of existing vessels into purse seiners has been generally under the supervision of the Fisheries Commission. Most converted vessels were former trawlers, some were Japanese second hand purse seiners and the rest Reparations multi-purpose vessels.

To convert an old trawler into a purse seiner, the wooden trawling platform at the stern end of the vessel was removed including the galley construction at the back of the pilot house. A fixed net platform was constructed at the stern end, single purse davit was installed at forward starboard side, immediately forward of the pilot house. Guideblocks were installed on deck transversely in line with the purse davit and horizontally with each of the two niggerheads. The mast and boom located at the bow were strengthened and rigged with ring lift and brailing blocks. In the initial stage an improvised mechanical net roller powered by chain from starboard winch drum was installed but later conversions always had puretic power blocks.

However, second hand boats purchased from Japan invariably had the Japanese net roller. To convert this two-masted type of boats into a power purse seiner, the Japanese roller together with its attendant shaftings and wooden constructions aft were removed. The light boom at the mid-deck was replaced with a strong steel boom to which the power block was hung. The cleared astern was provided with the net platform and a ring pole was installed at the starboard gunwale.

Forward the centrally located engine-pilot house is the mechanical winch which is belt or chain driven by the main engine. At the opposite starboard side, is a pair of Japanese purse davits. In some boats, the mechanical winch was discarded and released by a hydraulic winch installed directly in line with the forward pair of the Japanese purse davit. The astern purse davit was likewise discarded.

The forward mast and boom were retained and rigged with blocks and tackle for brailing and emergency use. Brailing booms were added for easy brailing. In addition, at least two

float booms were installed to prevent the floats from sinking due to the weight of the fish during fish drying process.

Reparations vessels belong to the two-masted type. Their conversion plan is very similar to that of the second hand Japanese tuna purse seiners.

Night time operation.—Night fishing is the dominant practice up to 1966, the period covered by this report. Day time fishing has not yet been successful. This is because the sardine nets are short ranging from 402 to 548 m. long. Trial day time fishing showed that a 457 m. long net is too short for fast moving surface schools. However, it is most effective for fish previously attracted to the light. The experience in attracting fish with light in basnig fishing method influenced the development of fishing at night time. Fish that has been attracted to the light can be compacted and brought to the surface by dimming, slooping and using red lights. Fish can also be transferred slowly from one light boat to another if the distance is short and direction of transfer is with the current. By virtue of these observations and experience, fishermen engage in night fishing without thinking seriously on day time fishing.

Types of net.—Sardine nets have 20 mm. mesh-size all throughout the body and 71 per cent of the nets have this mesh size while 29 per cent have 28.5 mm. mesh size. Sardine nets also catch big species which get attracted to the light such as Spanish mackerels and tuna.

Carrier boats.—Two carrier boats of about 1,500 tubs capacity (33 kg. per tub) are recommended for every purse seiner. The carrier is necessary to enable the catcher boat to remain continuously on the fishing ground while the carrier vessels alternately ferry the catch and supplies to and from the fishing grounds and at the same time assist the purse seiners in lighting. The system is economical considering that the purse seiners are not very big vessels and therefore do not carry much load, catches are generally not provided with refrigeration facilities and depend only on crushed ice to preserve the catch on board, and lastly, the fishing grounds are quite far so that the purse seiner would lose much time if it were to carry its catch daily to the market.

Lighting installations.—The purse seiner and the carrier vessels are provided with lighting facilities to attract fish at

night. Both have 30 to 80 Volt electric bulbs of 1,000 watts each distributed all around the vessel. Each light bulb is controlled separately by switches located in a centrally placed switch board. A few boats use submerged lights but there is not very much experience to show its advantages over the usual surface lights.

Attracting fish by light.—Lights are operated from sundown to sunrise. The seiner anchors right in the fishing ground at depths of from 55 to 100 m. The purse seiner, carrier, and other light boats anchor at about 800 to 1,600 m. distance from each other and arrange themselves in such a way that it is easy to transfer attracted fish from one light-boat to another or to the purse seiner according to prevailing wind and current set. Fish attraction is greater during moonless and especially overcast nights.

Determining fish attraction.—Fishermen are used to determine the presence and amount of fish under the light through fish air bubbles. Some use weighted copper wire. However, the use of an echo-sounder has become popular. Simple portable vertical types are installed in motored skiffs and are used to detect attracted fish. Permanently installed units in the purse seiner or carrier are also used especially in newly constructed and/or imported boats. A few vessels use European made asdic units.

Starboard operation.—Eighty-six per cent of the vessels operate on the starboard side. The remaining 14 per cent are now following the recommended starboard operation to prevent collision of boats working on the same school especially when day time fishing becomes in vogue. Majority of the Japan-purchased vessels are left or port operated.

Special gadgets.—As a result of the efforts of the Fisheries Commission to introduce improved techniques, the industry has increasingly used such specialized hardwares as brailer blocks, skiff release blocks, purse line release blocks, and various types of Norwegian-Iceland snap purse rings.

DESCRIPTION OF THE NET

General plan.—The purse net in general use is typically for sardine type, 402 to 548 m. long by 66 to 82 m. deep. The schematic plan and specifications of a typical 457 m. long sardine purse net is shown in Figure 8 and Appendix I.

Hanging rate.—The first imported ready made purse nets were hung at 30 per cent "Conventional Method" of determining hanging rate. (Methods of Determining Hanging Rate—Dinglasan, 1964, unpublished). This means that every 130 meshes of stretched netting is hung to 100 stretched meshes length of the hanging line. The trend, however, is toward greater hanging rate so that at present, some are hung up to 45 per cent at the center gradually decreasing to 30 per cent towards the ends.

Sections.—There are three major sections, viz. the wing, the main body, and the bag. The main body or the middle section comprises 58½ per cent, the bag or bunt section, 16½ per cent and the wing section, 25½ per cent of the total hung length

Twine size.—Of the body webbing, the bunt section has the largest twine size of No. 6 (210/18) or No. 7 (210/21). The wing section has the smallest twine size No. 3 (210/9) while the middle or main body section is of No. 4 (210/12) or No. (210/15).

Mesh size.—The body has a uniform mesh size of 22 mm. stretched. Mesh sizes of selvages and end nettings are shown in Appendix I and Figure 8. Smaller twines are used in the wing section because it is hauled first during the power blocking at which time the net has still no load of fish. This makes its cost correspondingly cheaper to the advantage of the operators.

Strips.—The strips in the wing and the middle section are hung horizontally while strips in the bunt are hung vertically.

Materials.—Nylon netting is recommended and preferred over all other synthetic materials because of its length. Its chief disadvantage is its lightness and therefore low sinking rate but which is offset by adding more weight to the lead line. Terylene ropes are used for hanging lines while cylindrical plastic floats are invariably used. It is conventional to use galvanized chain as leadline to give the necessary weight. Two sizes are used. Thirty per cent of the entire chain length is of 9.5 mm diameter and is mounted from the wing while 70 per cent of 8 mm. diameter is mounted from the opposite end.

Selvages.—The upper selvage is 91 mm. deep with the same mesh size and the body netting. It is machine woven from

Nos. 12–10–8 twine consecutively from top to bottom. The lower selvage is 2.7 m. deep in one strip of 594 m. long by 89 mm. mesh stretched by 210 d/96. The bunt end selvage is also vertically hung. In addition, there is a wing tip selvage of the same mesh size and twine specifications. It is made triangular by tapering and gathering the end meshes to a triangular becket.

MOUNTING THE NET ACCESSORIES

Floats.—The principle in determining the number of seine floats is related to its buoyancy as specified by the manufacturer, the total sinking power or weight of the net in water which must be buoyed up by the float, and an extra buoyancy necessary to make the net float even if affected by current, wind drift and pursing operations. The required total buoyant force is equal to the sinking power plus extra buoyancy. Therefore, the total number of floats is equal to the sinking power of the net per fathom (1.83 m.) plus the hung length multiplied by extra buoyancy per fathom all divided by the buoyancy per float.
Expressed mathematically:

$$N = \frac{S + LE}{b}$$

Where:

N = Number of floats
b = Buoyancy per float
L = Hung length of the net
S = Sinking power per fathom (1.83 m.)
E = Extra buoyancy per fathom

Number of purse rings.—The number of purse rings attached to the leadline primarily depends on the capacity of the purse winch. More rings mean heavier pursing and, therefore, the stronger the winch is, more rings can be installed. Another factor is the height of the ring lift block which should be equal to the length of one leg of the ring bridle plus one-half the length of the interval between the left and the right legs of the two adjacent ring bridles. It is impractical to have law ring lift height otherwise ring lifting cannot be done in

one hoisting and strapping the bridles for a second hoisting is usually a problem. The third factor is the distance of the first leg of the end ring bridles from the leadline corner of the net. This distance must be equal to the distance of the purse davit to the stern and bow of the vessel. With these factors considered, the number of the rings can be determined by the following formula:

$$N = \frac{L - (W + d/2)}{d} + 1$$

or

N = Number of rings
L = Hung length of the leadline
W = Total length of the ends of the net without ring bridles
d = Distance between rings

OPERATION

The operations are illustrated in Figs. 1–2.

Net stocking.—The net is stocked wing end first on the net platform with the bunt end on top of the pile. The float-line is placed on the left side and occupies about one-third of the width of the platform. The webbing is snaked starting from the forward end until the pile is high enough before moving towards the stern end of the platform. The last end of the net is placed very close to the extreme end for easy start of setting.

Preparation before setting.—Before setting the net, skiff is tied to the free end of the towing rope about 18.3 m. away from the stern of the purse seiner. The other end of the towing rope is fixed to a releasing device, known as the skiff release block. The free end of the pursing cable is released from the wire reel or drum, passed through the stern pursing block, through the purse rings of the ring pole, and is given to the skiff boat where 36.6 m. of it is coiled on deck. At the 36.6 m. mark, the purse cable is provided with an eye splice to which is connected Japanese tape cable wire stopper that is fixed on the boat. At 18.3 m. from the 36.6 m. mark, a similar eye splice is provided to which is connected the purse line release block that is fixed to the bottom corner of the net. When the purse seiner moves forward, the towing strain on the

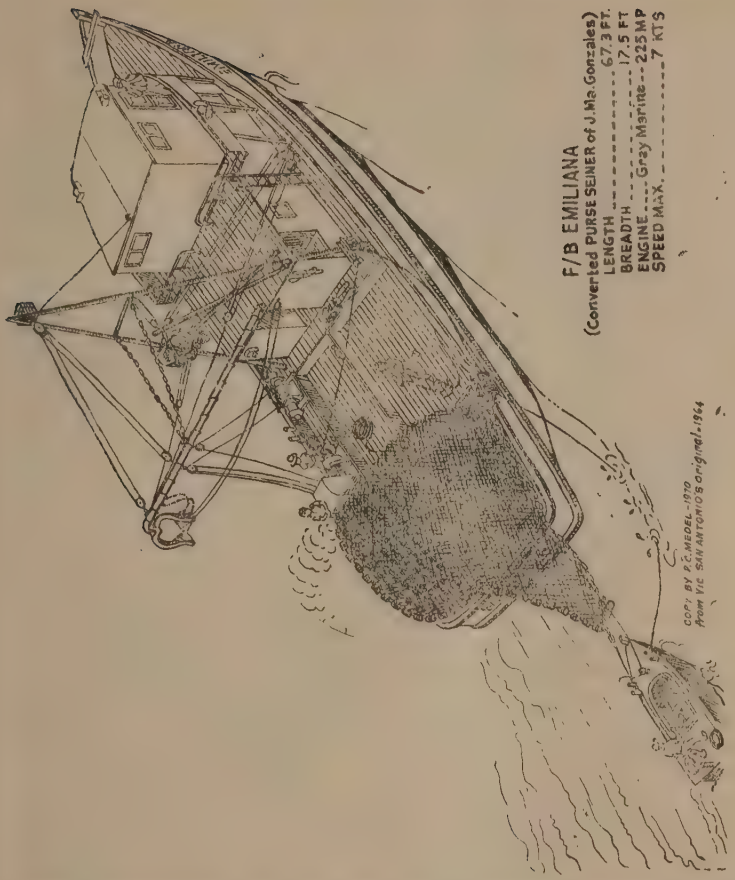
F/B EMILIANA
(Converted PURSE SEINER of J. Ma. Gonzales)
LENGTH ---------- 67.3 FT.
BREADTH ---------- 17.5 FT
ENGINE ---- Gray Marine --- 225 HP
SPEED MAX. ---------- 7 KTS
COPY BY P.C. NEDEL - 1970
FROM THE SAN ANTONIO'S original - 1964

FIGURE 1.– Start of setting. The purse seiner runs at full speed keeping the school of fish at its starboard side. When a correct position with current and drift is achieved the master fisherman calls, "let's go," whereby, the skiff boat tow line is released. The strain on the net by the skiff boat starts the shooting of the net platform. Note that as the net is being payed out, about the same amount of wire cable is released from the free-wheeling wire drum.

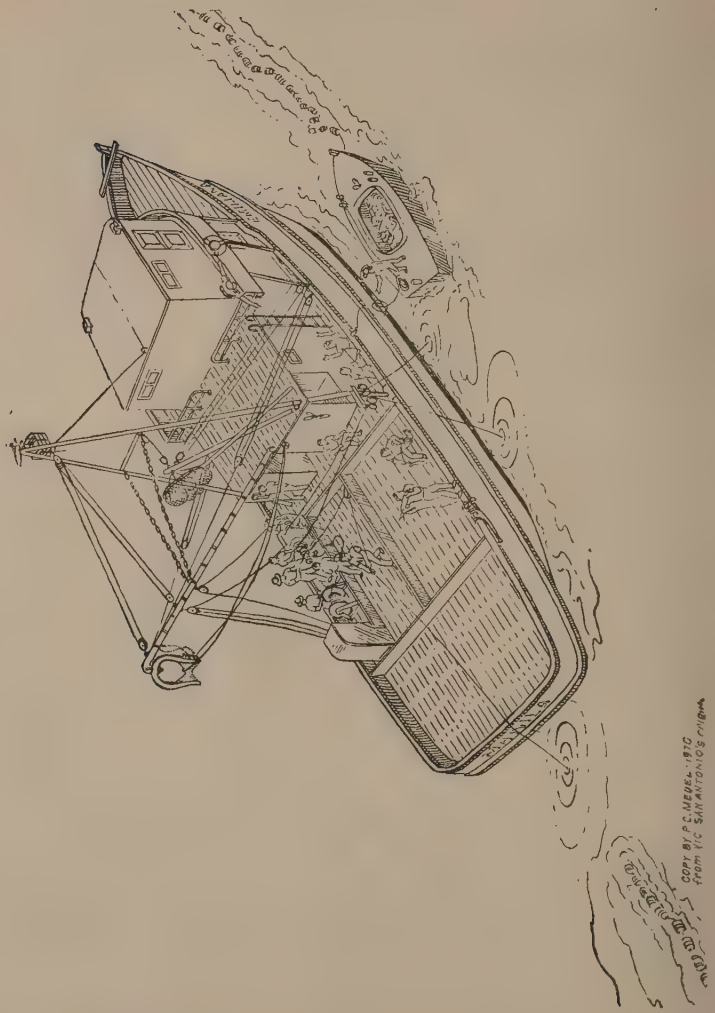

FIGURE 2.—Completion of the setting. The purse seiner makes a big circle around the school of fish. An extension rope is used when the net is not long enough to surround the school. Upon reaching the first end, the skiff boat throws the heaving lines connected to the net and the first end of the pursing cable. The latter is passed through the forward snatch block of the pursing davit.

skiff boat is mainly on the skill towing rope. The wing end pursing cable hangs between the purse seiner and skiff boat with a slight slack than the towing rope.

Setting.—Fish is first attracted by light and when an appreciable amount has been attracted, it is transferred to a small light boat, also called the dim boat. When fish is deep, it is brought up by slooping the light with a deep cone-shaped light reflector painted red inside. Slooping brings the fish very close to the light including those that ordinarily stay in the shadow. With this favorable behavior of fish to the light, the net is set at an average distance of 80 meters around the dim boat. The set is started at the lee side of the dim boat when the wind is quite strong or against the current set when the latter is stronger (Fig. 1).

Completing the circle.—The wing-end of the net is provided with a 11 m. long net arm to bridge the gap if the net is shorter than the circumference of the set. The last end of this line is secured in the boat so that in an unusually big circle, the completion of the set is attained by towing until the end is reached (Fig. 2).

Hauling in the net arms.—When the bag-end is received by the seiner from the skiff boat, it is hauled in through the forward guide block until the bag-end is hung close to the pursing davit. Simultaneously, the wing end pursing line is hauled in until the wing end is brought as close as possible to the pursing davit.

Hauling the breast line.—The first few nets introduced were provided with a draw string at the breast. The upper end of the draw string is provided with a ring stopper to prevent it from unthreading through the rings. When this end of the net is hauled in, this breast line is pulled as much as there is slack until the breast is closed and lifted up at the same time as the purse rings.

Pursing process.—Pursing is started immediately after the completion of the setting. The throw-line of the bunt purse line is received and hauled in to reach the beginning of the pursing line. This is passed through the forward block of the purse davit then wound several times to the forward drum in a horizontal purse winch installation or the portside drum

in a vertical purse winch installation. The wing-end purse line which is also in the stern pursing block of the purse davit is stopped and enough slack from the wire drum is obtained until so many turns of the wire had been made on the stern drum in a horizontal purse winch installation or to the starboard side drum in a vertical purse winch installation. Pursing is done as soon as both pursing lines are fed to the winch heads. The faster the pursing is, the shorter is the pursing time. The speed of pursing, however, is determined by the position of the purse line in the water. A shallow angle of the line to the water level means that the net is fishing very shallow in the water in which case the pursing rate is slowed down. Usually, pursing is completed in fifteen minutes. Pursing is completed when the purse rings are bunched and surfaced. The winch is then stopped and locked to prevent the purse line from sliding back into the water (Fig. 3).

Ring lifting.—Ring lifting not only brings the leadline the rings on deck but also lifts out of the water the large meshed bottom selvage through which the fish will sieve through if allowed to hung in the water. First, a wire strope with bights at both ends is passed through all the pursed rings under the purse davit. The two bigths of the strope are hooked to the lower ring block then hoisted up to the power block boom in a one-masted type seiner or to the forward boom in a two-masted type seiner, or to the sampson post in the Japanese purse seiner. If the ring lift height is not enough, a second hoisting is made to bring the lead line over to the gunwale and to surface the large meshed bottom selvage strip. The leadline, ring bridles, and the purse rings are then lowered on deck, and a line whose one end is secured somewhere is passed through the rings to prevent the leadline from going back into the water especially during rough weather when the boat rolls very much (Fig. 4).

Snapping the purse rings.—The purse line is removed by snapping all the purse rings one by one. A few Japanese net, however, do not have snap rings. Instead, they are provided with large closed type iron rings. In this case, the purse line is made in three pieces connected by a chain link through which the purse rings are removed before the net can be stacked on the net platform.

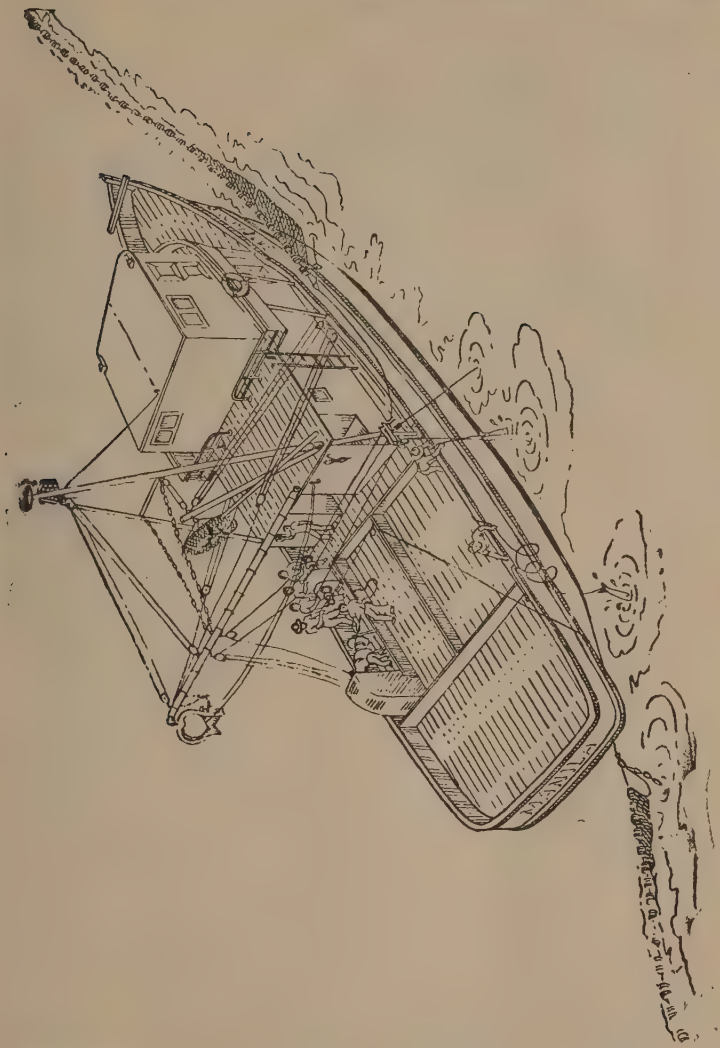

FIGURE 3.—Start of pursing. The pursing line is hauled on the nigger-heads of the winch. The hauled wire is returned to the wire drum. At this stage, there is a big opening under the boat where fish can escape. Wooden fish, painted white and provided with weight at head are used to scare them away from the boat.

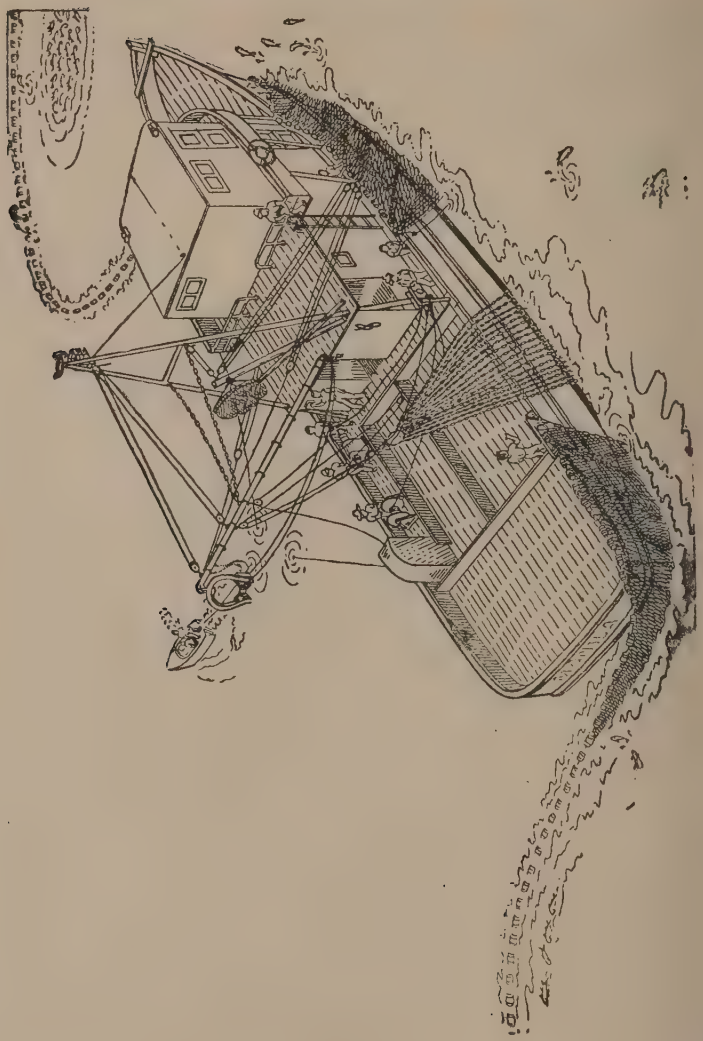

FIGURE 4.—Completion of pursing and ring lifting. Pursing is the process of closing the bottom of the net by means of the pursing lines passed through a series of rings attached to the bottom of the net. Upon completion, the pursed rings eventually come up of the water. A wire strap is passed through all the rings and then lifted by the ring lift block until all the rings are up in the air. This is called ring lifting. After all the bottom line is above deck, the rings are lowered.

Power blocking.—Power blocking is the process of stacking back the net from the water into the platform by means of the power block. The beginning of the net is tied to one end of the starter line which has been previously passed through the sheave of the power block. The power block is then switched on while one man pulls the other end of the starter line. The power block rubber sheave provided the necessary traction so that the net end goes up through the power block until it falls on the net platform. At this juncture, the fishermen assume their assigned posts on the net platform. They arrange the floatline on the portside while one man arranges the leadline on the starboard side of the platform. Another man takes care of the purse rings by threading them through the ring pole consecutively as they come along. Three to four men arrange the webbings in snake fashion. The leadline, ring bridles and purse rings are fed to the power block by one man working at the starboard deck between the pursed rings and the ring pole. Every now and then, the power block is disengaged when necessary so as to remove gilled fishes in the webbings or to disentangle the webbings or any part of the net that is caught to some objects in the vessel. Otherwise, power blocking would be a continuous process, as long as the fishermen are able to stack the net in good order as it falls from the power block. Power blocking is stopped when there is just enough bunt floatline remaining in the water. At this juncture, the net is dried to harden the fish preparatory to brailing. Power blocking is resumed after brailing the fish until all the net is back on the boat. Power blocking time depends principally on the length of the net and amount of gilled or entangled fish in the meshes which must be removed or they will give foul odor to the net. A 457 m. net usually requires 20 minutes power blocking time (Fig. 5).

Drying up the fish.—The net, which remains in the water is hauled in to harden the catch in the bunt. Every man pulls the net evenly and all at the same time until they can pull no more. If the catch is extraordinarily heavy and the fish could not be surfaced to a depth that can be reached by the brailer, the net is dried by means of strapping the webbing. Drying the fish by means of the power block and the tapered

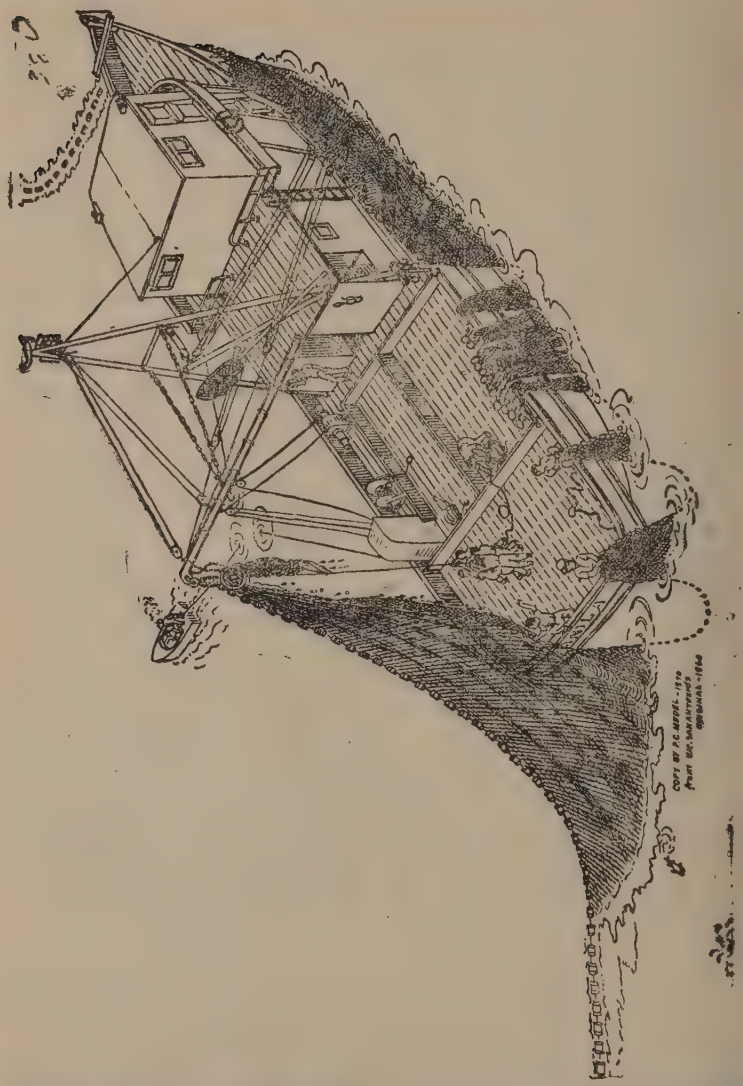

FIGURE 5.—Power blocking. Power blocking means returning the net to the net platform. This is done by passing the first end of the net into the sheave of the hydraulic power block. The net is automatically raised from the water on the net platform and as it drops, it is piled by the fishermen in a nice way on the net platform ready for the operation. The net is started on the power block by means of a line passed through the power block. One end is tied to the beginning of the net while the other end is held by several men. Upon reaching the last end of the net which is really the bag or bunt, power blocking is stopped. At this stage, the catch has already been impounded at this part of the net ready for brailing.

bunt is suggested by Jacobson, Modern Fishing Gear of the World, p. 304, vol. 2. A tapered bunt is objected to on the ground that it fishes very shallow, and therefore provides fish a chance to escape at this part of the net. However, some boats prefer tapered bunt and wing end selvages for reasons of convenience of operation.

Brailing.—Brailing is done by means of a brail, provided with a long wooden pole. Its iron circular frame is bridled to a shackle which is connected by hooking to the brailing tackle at the boom. The brail may be rigged direct to the power block boom. One or two separate brailing booms are also in use. Provision, however, of the two special brailing booms enables the direct brailing of fish from the net to the carrier vessel. The bottom of the brail is open and provided with a series of rings threaded through with a purse line that goes to the guiding block under the head of the bridle thence through a ring eye on the handle while the free end is secured to a pin and held by the brail operator. The brail is pulled as far back as possible before lowering it to dig into the fish. At the proper signal, the winch man hoists the brail thus bringing it up with a load of fish. Hoisting is continued until the lower part of the brail is over the gunwale. It is then centered to drop the fish on the deck. Once centered, the bottom purse line of the brail is released, thus opening and allowing the fish to drop on the deck. A few boats are using brailing blocks which is a decided improvement over the purse string release method in that the opening on of the brail is automatic at a slight jerk on the leasing line (Fig. 6).

After brailing all the catch, the power block is operated once more until all the net has been brought to the net platform. Necessary attachments are made to make the net ready for the next set (Fig. 7).

APPENDIX I

SPECIFICATIONS OF SARDINE PURSE SEINE

457 m. × 76 m. stretched
594 m. stretched × 76 m. stretched
30% hung

A. Netting, one piece of each section as follows:
1. Wing—98 m. × 73 m. 20 mm. × 210/9, 1 piece

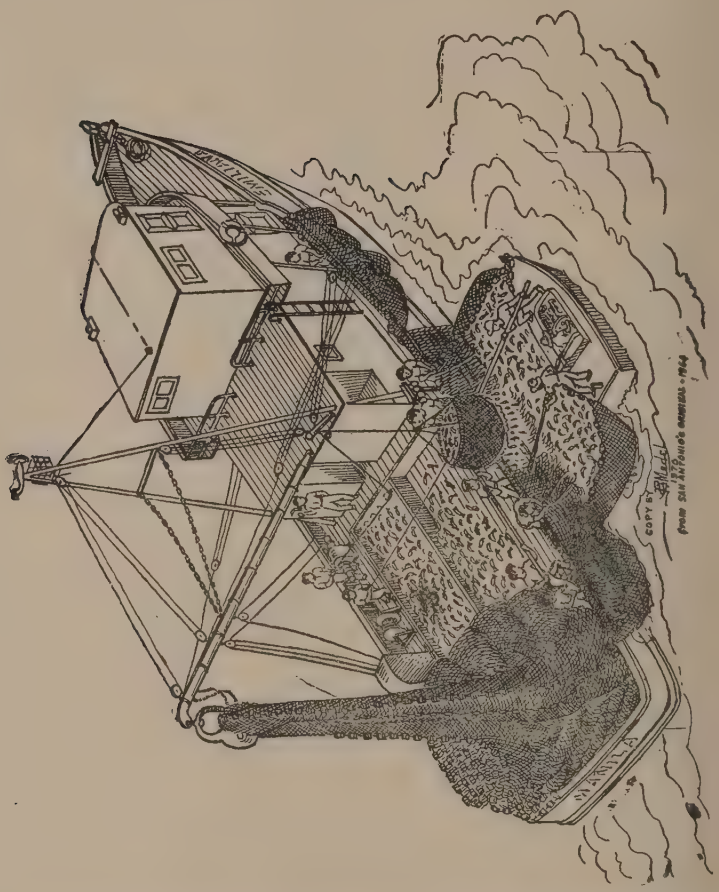

FIGURE 6.—Brailing. After impounding the catch at the bag, it is hardened by pulling the netting under. When hard enough, brailing is started to transfer the fish from the net to the boat deck. Brailing is done by means of a big scoop net hauled by winch. Note that the brailer is open at the bottom and closed only by pursed rings. When the pursing is released, the catch drops on deck.

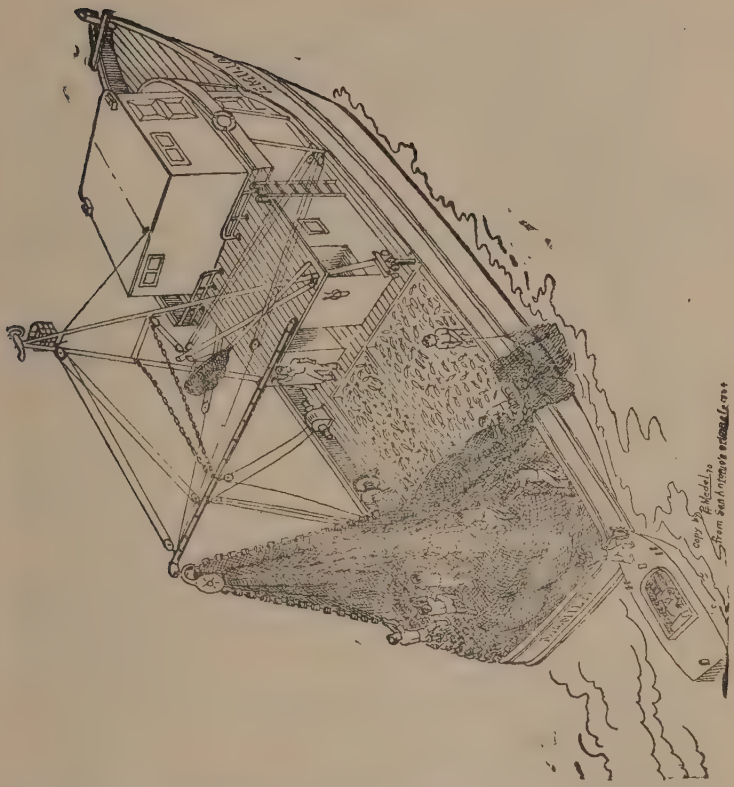

FIGURE 7.—Completion of net stacking. After brailing all the catch, the power block is operated once more until all the net has been brought to the platform. Necessary attachments are made to make the net ready for the next set.

2. Body—373 m. × 73 m. 20 mm. × 210/15, 1 piece
3. Bunt—118 m. × 73 m. 20 mm. × 210/21, 1 piece
4. Upper selvage: 589 m. × 20 mesh deep, 20 mm. × 210/d 36–30–24, 1 piece
5. Lower selvage: 594 m. × 1.83 m. 8.9 cm. mesh × 210d/96, 1 piece
6. Bunt side selvage: 3.66 m. × 76 m. 8.9 cm. mesh × 210d/96, 1 piece
8. Wing tip selvage: 300 meshes × 550 meshes, 8.9 cm. mesh × 210d/96, to be shaped as per accompanying plan.

210d/96, 1 piece

7. Wing side selvage: 1.83 m. × 73 m. 8.9 cm. mesh ×

B. Lines in finished lengths as follows:

1. Leadline—Terylene, 1.6 cm. D × 477 m.
2. Floatline—Terylene, 1.6 cm. D × 478 m.
3. Bunt breast purse line—Terylene, 1.6 cm. D × 76 m.
4. Bunt breast purse line—Terylene, 1.6 cm. D × 76.8 m.
5. Bunt breast ring bridle—Terylene, 1.6 cm. D × 1 m. × 2 × 16.5 m.
6. Weight—Chain, G. I., smooth finish, 0.95 cm. D. 320 m.
   Chain, G. I., smooth finish, 1.6 cm. D. × 157 m.
7. Purse ring bridle—Chain, G. I., smooth finish, 6.4 mm. D, 2.7 m. × 2 × 80.4 m.
8. Purse line—Flexible galvanized steel wire, 1.43 cm. D × 640 m.

C. Rings:

1. Purse ring, snap type, brass, 1.9 cm. thick × 15.2 cm. D, 44 pieces.
2. Bunt breast ring, closed type, G. I., 1.3 cm. thick × 10.2 cm. D, 10 pieces.
3. Bunt breast line ring—snap type, brass, 1.9 cm. thick × 15.2 cm. D, 1 piece.

D. Floats:

Synthetic, cylindrical 10.2 cm. × 15.2 cm. × 1.6 cm. hole, 2,700 pieces.

ILLUSTRATIONS

TEXT FIGURES

FIGS. 1. Start of setting. The purse seiner runs at full speed keeping the school of fish at its starboard side. When a correct position with current and drift is achieved the master fisherman calls, "let's go," whereby, the skiff boat tow line is released. The strain on the net by the skiff boat starts the shooting of the net platform. Note that as the net is being payed out, about the same amount of wire cable is released from the free-wheeling wire drum.

2. Completion of the setting. The purse seiner makes a big circle, around the school of fish. An extension rope is used when the net is not long enough to surround the school. Upon reaching the first end, the skiff boat throws the heaving lines connected to the net and the first end of the pursing cable. The latter is passed through the forward snatch block of the pursing davit.

3. Start of pursing. The pursing line is hauled on the niggerheads of the winch. The hauled wire is returned to the wire drum. At this stage, there is a big opening under the boat where fish can escape. Wooden fish, painted white and provided with weight at head are used to scare them away from the boat.

4. Completion of pursing and ring lifting. Pursing is the process of closing the bottom of the net by means of the pursing lines passed through a series of rings attached to the bottom of the net. Upon completion, the pursed rings eventually come up of the water. A wire strap is passed through all the rings and then lifted by the ring lift block until all the rings are up in the air. This is called ring lifting. After all the bottom line is above deck, the rings are lowered.

5. Power blocking. Power blocking means returning the net to the net platform. This is done by passing the first end of the net into the sheave of the hydraulic power block. The net is automatically raised from the water on the net platform and as it drops, it is piled by the fishermen in a nice way on the net platform ready for the operation. The net is started on the power block by means of a line passed through the power block. One end is tied to the beginning of the net while the other end is held by several men. Upon reaching the last end of the net which is really the bag or bunt, power blocking is stopped. At this stage, the catch has already been impounded at this part of the net ready for brailing.

6. Brailing. After impounding the catch at the bag, it is hardened by pulling the netting under. When hard enough, brailing is started to transfer the fish from the net to the boat deck. Brailing is done by means of a big scoop net hauled by winch. Note that the brailer is open at the bottom and closed only by pursed rings. When the pursing is released, the catch drops on deck.
7. Completion of net stacking. After brailing all the catch, the power block is operated once more until all the net has been brought to the platform. Necessary attachments are made to make the net ready for the next set.

PRELIMINARY STUDIES ON THE COMPARATIVE CHEMICAL COMPOSITION OF THE DIFFERENT COMMERCIAL BRANDS OF "PATIS" IN THE PHILIPPINES [1]

By S. V. Bersamin and R. S. J. Napugan
Of the Philippine Fisheries Commission

ABSTRACT

Various commercial brands of patis (fermented fish sauce) were analyzed comparatively, for their moisture, total solids, total nitrogen and sodium chloride contents.

From the standpoint of nutrition, those with higher total nitrogen contents are considered the better grades. The total solids range from 28.56 per cent to 37.81 per cent and sodium chloride from 22.26 per cent to 26.44 per cent. Samples with high total solids have better keeping quality because of low moisture content.

Although almost all the brands fall within the range requirement of total nitrogen, sodium chloride and total solids set by the Philippine Standard Association, yet as revealed by the analysis, these standards and requirements are met without technological planning and no effort is being made by the manufacturers to produce uniform standard grades of patis.

INTRODUCTION

Patis or fish sauce, a popularly known condiment in the Philippines, is a well-aged, fermented salted fish product. It is a clear liquid sauce, straw yellow to amber in color, obtained from the slow digestion of salted fish or shrimps. It is extensively used in the Philippines for flavoring food in much the same way as soy sauce is used in Japan and China, nuocnam in Cambodia, and nampla in Thailand. The Philippines is claimed to be the first among the countries in the Far East to engage in the manufacture of patis. Fish used in the manufacture of patis are also in the manufacture of bagoong (fermented fish paste). Often, these two products are manufactured together.

No accurate standard has yet been promulgated for the composition of patis. A tentative definition as established by the United States Fish and Wildlife Service is "the finished

[1] Presented at the Indo-Pacific Fish Council Meeting, 1961.

products shall have total solids of not less than 35 per cent; shall contain not less than 10 per cent protein (16 grams/liter total nitrogen) and not less than 20 per cent or more than 25 per cent by weight of salt. It may contain added spices or other flavoring materials as well as approved coloring materials."

Small fish such as anchovies (dilis) and alipmouths (sapsap) are commonly used in the manufacture of fish paste. These fish are of little commercial importance in retail trade so that they are usually bought from fishermen in large baskets and used to make bagoong. During the fermentation stage, the fish are usually disintegrated and the liquid produced in this process is filtered off as patis or fish sauce. The manufacture of patis passes through the bagoong stage. After the first extraction, saturated brine is added to the bagoong residue, letting it stand for a certain number of days to make ready for the second extraction. This procedure is continued until all the fish flavor has been extracted. This accounts for the various grades of patis presently sold in local markets.

The fresh fish are thoroughly washed with fresh tap water, and all dirt and other extraneous materials are removed. Salt is added and thoroughly mixed with the fish with the proportion of one to three or two to seven parts by weight. Wooden vats and shovels constitute the equipment needed for this process.

The mixture of salt and fish is usually placed in wooden vats or earthenware containers and allowed to undergo fermentation until the characteristic aroma and flavor brought about by the breakdown of fish proteins are produced.

Experiments conducted by the Philippine Fishery Program of the U. S. Fish and Wildlife Service (1950) show that the use of pure salt has advantages over the ordinary solar salt in the manufacture of bagoong and patis. The rate of fermentation during the early stages of digestion becomes twice faster in bagoong salted with pure salt than with impure solar salt. It was found out further that a storage temperature of 45°C for the first week and 37°C for the next 2 weeks gave the same degree of fermentation as what would normally result after a storage period of six months under ordinary temperatures.

High quality or better grades of patis are prepared from anchovies, goby fry, herring fry, and small shrimps. A cheaper grade of patis is prepared by mixing the residue from a series of extraction with saturated brine solution. Others sell the residue which is grounded and mixed saturated brine to get the proper consistency, after which a small proportion of good anchovy bagoong is added to simulate a genuine anchovy bagoong.

The grade and kinds of container determine the market price of the patis, but in most cases, experienced buyers judge the grade according to its color and flavor. The various grades are classified as *especial, extra,* and *primera.*

The aim of this investigation is to make a comparison of the chemical composition of the various commercial brands and grades of patis that are presently manufactured in the municipalities of Navotas and Malabon of Rizal Province and vicinities. The main bulk of the production of patis in the Philippines comes from these municipalities. The results of these analyses could serve as a guide to consumers from the standpoint of nutrition.

MATERIALS AND METHODS

Patis packed in bottles were purchased at random from the different markets of Manila and suburbs.

Twenty-two samples were analyzed in the Chemical Research Laboratory of the Philippine Fisheries Commission for moisture, total solids, total nitrogen and sodium chloride contents. The analytical methods used were those of the standard methods as prescribed in the official and tentative methods of analysis of the Association of Official Agricultural Chemists (AOAC).

RESULTS AND DISCUSSION

Table 1 shows the results of the analysis of the twenty-two samples. It can be noticed from the Table that there is a marked difference among the various grades of patis as regards their chemical composition.

For clarity and comprehension of the standards set by the Philippine Standards Association (PSA) in relation to the

local terminology of patis grades found in the local markets, the following guide is being adhered to in this study:

LOCAL TERM	PSA EQUIVALENT
Especial (First extract)	First class (A)
Extra (Second extract)	Second class (B)
Primera (Third & Fourth extract)	Popular (C)

TABLE 1.—*Comparative chemical composition of various brands of patis.*

Brand numbers	Class	Moisture (Per cent)	Total Solids	Total nitrogen GM liter	Sodium chloride (Per cent)
1. Brand No. 1	First class (A)	63.15	36.85	22.59	22.20
2. Brand No. 1	Popular class (C)	67.54	32.46	12.30	23.67
3 Brand No. 2	First class (A)	62.41	37.58	27.64	23.16
4. Brand No. 2	Popular class (C)	69.22	30.77	10.13	24.58
5. Brand No. 3	First class (A)	64.36	35.64	23.84	22.41
6. Brand No. 3	Popular class (C)	74.15	25.85	8.62	22.26
7 Brand No. 4	First class (A)	62.68	37.32	23.14	22.86
8. Brand No 5	Second class (B)	68.81	31.19	6.89	25.51
9 Brand No 5	Popular class (C)	71.54	28.56	5.42	23.31
10 Brand No 6	Second class (B)	65.44	34.56	19.66	25.98
11 Brand No 6	Popular class (C)	69 78	30.22	7.01	23.54
12 Brand No 7	First class (A)	62.85	37.15	20.42	26.44
13 Brand No 7	Popular class (C)	67.19	32 81	9.71	25 26
14 Brand No 8	Popular class (C)	63.16	36,84	10,99	24·15
15 Brand No 9	First class (A)	62.93	27.07	23.10	23·84
16 Brand No 10	First class (A)	62,19	37.81	21,71	23·76
17 Brand No 11	First class (A)	64.35	36.65	20.68	24·44
18 Brand No 12	First class (A)	63.61	36.39	24.35	23·97
19 Brand No 13	First class (A)	63 94	36.06	26.92	25·19
20 Brand No 13	Second class (B)	68.44	31.56	14,58	25 97
21 Brand No 13	Popular class (C)	70.52	29.48	9.78	25.51
22 Brand No 14	First class (A)	64.66	35.34	2 57	23.67

Those with higher total nitrogen are considered the better grades. First class (A) is rated as the highest; second class (B) as next; and Popular class (C) the lowest. The sodium chloride content ranges from 22.26 per cent to 26.44 per cent and the total solids from 28.56 per cent to 37.81 per cent. It was also found that samples with high total solids have better storage and keeping quality because of the lower moisture content. Presence of moisture is responsible for the growth of molds.

At a public meeting of the Philippine Standards Association held on September 4, 1958, which was attended by local technologists representing government and private entities, producers and consumers, the following quality standards for bagoong and patis were adopted by the Association:

"Fish bagoong made of small fresh fish and common salt with not less than 85 per cent sodium chloride should contain in the whole substance, the following: total solids, not less than 40 per cent; protein (Nx6. 25), not less than 12.5 per cent; total nitrogen, not less than 20 grams/liter; and sodium chloride, not less than 20 and not more than 25 per cent".

Shrimp bagoong, made of small shrimps and common salt with not less than 85 per cent sodium chloride, should contain in the whole substance the following: total solids, not less than 35 per cent; total nitrogen, not less than 16 grams/liter; and sodium chloride not less than 20 and not more than 25 per cent.

Bagoong must be packed, stored, exported, transported, offered for sale in receptacles made of glass, earthenware, porcelain, chinaware, or wooden barrels for export trade. The use of tin cans may also be permitted provided they are new and clean, and not made out of rusty or painted second hand material. These receptacles must be tightly covered, closed or sealed to avoid any leakage or foreign contamination by flies, spoilage agents or pathogenic organisms and poisonous substances. Receptacles for bagoong must serve not only as containers but also as index of quality and sanitation of the product.

Patis is obtained by decanting and/or pressing or centrifuging the bagoong after it has been thoroughly fermented or disintegrated with or without the addition of boiling brine and allowed to settle or concentrated by boiling.

Fish patis should have a specific gravity between 1.21 and 1.22 and the alkalinity of the water-soluble ash of one gram of the original sample should not be less than one cubic centimeter of the tenth normal acid, and total solids not less than 32 per cent.

In addition, various brands of patis should meet the following specifications: first class (A), total nitrogen, not less than 20 grams per liter; second class (B), total nitrogen, not less than 14.4 grams per liter; and popular (C), total nitrogen, not less than 9.6 grams per liter.

The specific gravity, alkalinity of water, soluble ash, and the percentage of total solids and protein of shrimp patis correspond to those in fish patis and its various brands.

Extract is the liquid termed as patis obtained from a bagoong stock.

Recommended receptacles for patis are glass containers of 35 to 750 ml. capacity. Glazed earthen jars or gallon jars are appropriate containers intended for export trade in bulk, for institutions, hospitals, restaurants and other food establishments.

CONCLUSION

Twenty patis samples were analyzed according to their moisture, total solids, protein and sodium chloride contents.

The percentage of protein of the especial grades of patis falls within the proposed standard set by the Philippine Standards Association, that of "having not less than 12 per cent protein for patis of the first class (A) or *especial grade.*"

One brand, Brand No. 5–second class (B) having 6.89 grams per liter total nitrogen, does not even conform with the require ment for popular (C) which is not less than 9.6 grams per liter total nitrogen.

Six out of 20 samples do not conform with the total solids requirement of the PSA that of "having not less than 32 per cent." The percentage of total solids of all the samples analyzed is directly proportional to the percentage of protein.

Nineteen samples conform with the sodium chloride requirement of "not less than 20 and not more than 25 per cent." One patis sample, Brand No. 7, first class (A), having 26.44 per cent exceeds the sodium chloride requirement.

Different brands having the same grades cover a wide range of percentages of total solids protein and sodium chloride.

RECOMMENDATIONS

Results of analyses made on patis brands commonly found in the metropolitan markets of the country reveal that there is little effort made on the part of the manufacturers to produce consistently high quality products that would safeguard the needs of the consuming public. If ever there are brands that fall within the proposed standards set by the Philippine Standards Association, these standards are met only by chance, that is, without any technological planning and not based on known systematic methods of patis preparations.

The volume of patis for domestic and export trade is increasing yearly (Fisheries Statistics of the Philppines, 1948–51) and this clearly indicates that patis manufacturers are proportionally increasing, too. To offer a safeguard to the buying public, here and abroad, against misbranded and adulterated patis with resultant high quality products the following recommendations are presented:

1. Patis manufacturers must conform with the requirements set forth by the Philippine Standard Association as regards the preparation and standarization of packs;

2. Patis manufacturers must have an analysis laboratory to conduct routine samplings of all the products especially those for export trade; and

3. The government entity concerned should conduct periodic examination of the operation, packing and packaging of products of patis establishments to check misbranding and adulteration.

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CULTIVATION OF "SUGPO" (JUMBO TIGER SHRIMP), PENAEUS MONODON FABRICIUS IN THE PHILIPPINES [1]

By M. N. Delmendo and H. R. Rabanal
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SIX TEXT FIGURES

The cultivation of "sugpo" (jumbo tiger shrimp), *Penaeus monodon* Fabricius, has become an important and lucrative undertaking in estuarine fishponds. In the Philippines, juveniles of this species rank next to *Chanos* fry in market demand and value compared with other salt water stocking material. Sugpo are caught in almost all places where *Chanos* fry are collected but they appear at a somewhat later period.

Among the species of commercial shrimps of the genus *Penaeus, P. monodon* is the most highly esteemed by the consumers. Being considered a table delicacy it commands the best price whenever present in local markets. A kilogram of marketable sugpo costs from five to eight pesos, whereas other shrimps like the "hipong-suahe" (*Penaeus canaliculatus*), "hipong-puti" (*Penaeus indicus*) and "hipong-culot" (*Penaeus sp.*) cost from two pesos [2] to five pesos per kilogram.

Shrimps, when present in fishponds in addition to the cultivated species, are found to be harmless to the main crop of cultivated milkfish. Further, they provide an additional income to the culturist. Hence, it is that sugpo are deliberately gathered and stocked in the ponds to be grown to a marketable size.

The production of *Penaeus* in estuarine fishponds in the Philippines resulting from the normal shrimp population that enter the pond during the cultivation period is estimated to range from 50 to 200 kilograms per hectare per year. If, however, in addition to this normal stock, sugpo fry is introduced into the ponds, shrimp production per hectare per year may be raised to 500 kilograms of which about 70 per cent may consist of *P. monodon*.

[1] Presented at the Indo-Pacific Fish Council Meeting, 1961
[2] Two pesos equal one U.S. dollar

In spite of the promising aspect of the shrimp culture industry, scientific studies along this line are still meager. The present paper embodies the results of an attempt to study the rate of growth of sugpo in ponds, with notes on some problems and the technique of its cultivation in the Philippines. The study was undertaken at the Dagat-dagatan Salt Water Fishery Experimental Station, Malabon, Navotas, Rizal Province, Luzon and covered the periods of September 1943 to April 1944 and September 1950 to August 1952.

Sugpo fry bought from dealers in addition to those collected in the Dagat-dagatan lagoon were stocked in the nurseries of the Bureau of Fisheries at Dagat-dagatan. Weekly samples were taken and measured from the time they were stocked in the nursery ponds until they were transplanted to the bigger rearing ponds and monthly measurements of samples from these latter ponds were subsequently made. Sampling the nursery ponds was effected by using fry lures or bon-bon. When the sugpo abandoned its clinging habit, sampling was made by random catches by hand or by traps.

The juvenile sugpo is dark brown to almost black in colour. The body is firm and straight when undisturbed in the water and could easily be mistaken for a small fragment of stick or debris. The physical features of a young sugpo are similar to those of a mature one except that the body colouring changes in the course of growth. The fry is dark blackish, being opaque, while the bigger size is dark bluegreen and somewhat translucent.

The sugpo fry (Fig. I) caught from the fry grounds measured on the average 15.3 mm. in total length, 1.6 mm. in body depth and weigh 0.025 grams.

Although the shrimps were subsequently carefully measured and weighed at monthly intervals, their subsequent growth cannot be said to show any conclusive results as there was considerable variation during the three periods of observation (as much as one order of magnitude during the earlier months). Moreover, the experiment was carried to the twelfth month during the 1951–1952 season only. The average figures shown in Table 1 are, therefore, for the present given merely as a rough guide as to the approximate sizes likely to be encountered at monthly intervals after capture. The exact age of the fry at commencement of the experiments is not known.

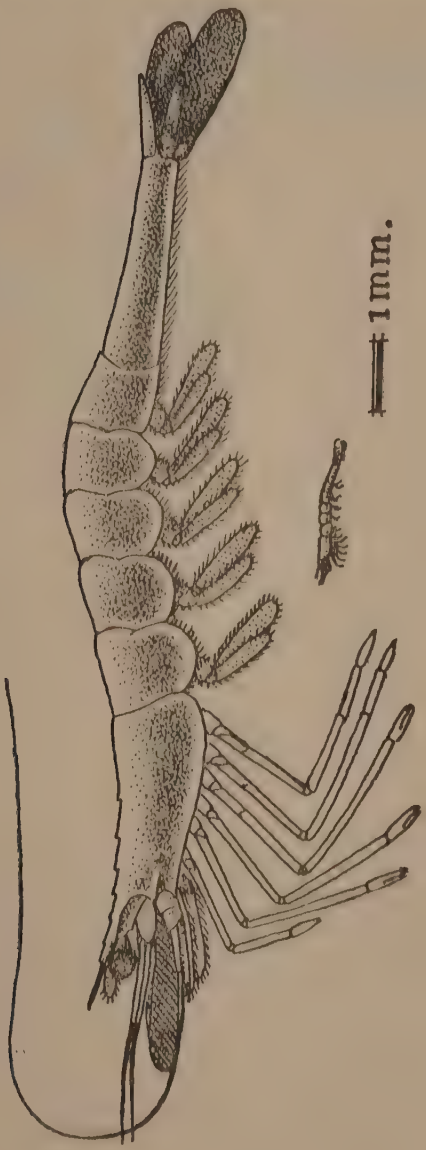


FIGURE 1.—The fry of sugpo, *Penaeus monodon*.

TABLE 1.—*Average rate of growth of Penaeus Monodon under cultivation.*

Duration of culture	Total length (mm)	Body depth (mm)	Weight (g)
Fry	15.3	1.6	0.025
One week	21.5	2.5	0·06
Two weeks	28.2	3.6	0·08
Three weeks	38.8	4.5	0·92
Four weeks	45.3	5.7	0·78
Four weeks	45.3	5.7	0·78
Five weeks	57.1	7.8	1.63
Six weeks	60 3	9.7	3.39
Seven weeks	69.5	10.9	4.36
Two months	79.0	9.8	4.34
Three months	94 7	11.1	6.88
Four months	120.0	15 3	1.45
Five months	Incomplete	Incomplete	Incomplete
Six months	141.9	18.3	22.3
Seven months	152.6	16.4	25.1
Eight months	Incomplete	Incomplete	Incomplete
Nine months	178.0	27.8	57.3
Ten months	211.6	30.2	62.8
Eleven months	223.0	32.0	70:7
One year	229.8	32.0	95.1

Note: The data for the ninth to twelfth months are for the 1951–52 season only are therefore not strictly comparable with averages for the earlier periods.

It will be seen that the sugpo which had been held in ponds for one year (Fig. 2) measured on the average 229.8 mm. in body depth and weighed 95.1 grams. The largest specimens of this age may, however, measure as long as 250.0 mm. weighing about 120 grams while others may be as small as 180.0 mm. long with a weight of 50 grams. A kilogram of one year old sugpo may contain 8 to 20 individuals.

THE "SUGPO" FRY INDUSTRY

It is probable that the sugpo spawn in the sea, not far from the coast and that the young are carried to shallow coastal areas, tidal rivers and estuaries by the incoming tide. They also enter fishponds through the coarse screens of the water control gates, where they constitute a welcome and gratuitous addition to the cultivated fish crop. Not a few uninformed caretakers in fact regard the presence of these unstocked species in the ponds as "singaw" or spontaneous products, because they pass through the gates unnoticed when small but later constitute a part of the harvest.

The sugpo fry season begins in the month of May and extends up to October, the peak of the season occurring in August and September. The shrimp fry industry consists of

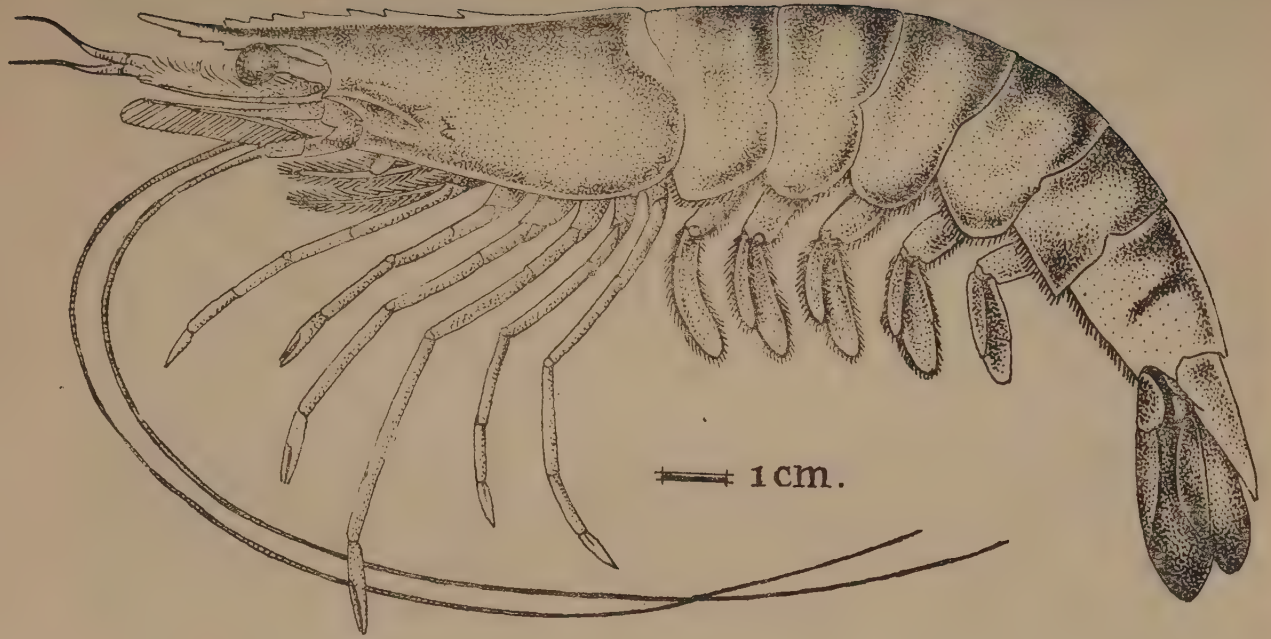


FIGURE 2.—A full grown sugpo, *Penaeus monodon*.

the catching, sorting and distribution of the fry to fishpond centers. Unlike the *Chanos* fry industry, it involves very little investment. *Chanos* fry grounds are leased by the municipal government to individuals; sugpo, on the other hand, are gathered from the fishing grounds without any fee.

The fry are caught by lures from natural waters. These lures, locally called 'bon-bon' are made of bunches of small aquatic plants and grasses. The species most commonly used for this purpose is a salt water grass, *Paspalum vaginatum*. Bunches of this grass are tied to form circular pieces, which in turn are tied to a long line of string, rattan or wire, and then set in the fishing ground. These lines of lures are tied at intervals of ten to twenty meters to lines of bamboo or wooden poles near the bank. Several such lines can be set in a tidal river or stream provided they do not obstruct the passage of small craft.

From a wooden dugout or 'banca' the collector gathers the fry by means of a dip net. They are then scooped up with a white porcelain bowl and transferred to an earthern jar. Collection is made twice or more at any time of the day, regardless of weather and tide conditions. The fry are sorted during the collection so as to get rid of extraneous species and are finally distributed in earthen containers of fishpond owners, at a price of from one peso and fifty centavos to six pesos per hundred.

Method of raising.—There is no standard method of raising 'sugpo' in ponds. Fishpond operators in brackish and salt-water areas generally look upon shrimp cultivation as a supplementary source of income and seldom are special ponds set apart for this purpose. Fish or shrimp fry may be stocked exclusively in prepared ponds, or in nursery ponds used for *Chanos* or in the transition and rearing ponds, with or without previous preparation and with or without other species.

The best results have been observed where the shrimp fry are stocked in previously prepared nursery ponds. The preparation of these nurseries for sugpo cultivation is similar to that of *Chanos*, that is, by cleaning, levelling, draining and drying the bottom.

Sugpo fry are plankton feeders and so before stocking the nurseries, measures are taken to achieve a luxuriant growth

of the micro-benthic biota or 'lab-lab' as in *Chanos* culture. Once this fish food is well developed in the pond bottom, the water is renewed and the nurseries are ready for stocking. In a pure type of culture the jumbo tiger shrimp is the only stock reared in the ponds. In a mixed culture the sugpo fry are planted in nursery pond previously stocked with *Chanos* fry. The stocking intensity is highly variable depending on supply but a hectare of nursery may accommodate as many shrimp fry as bangos (*Chanos*) fry, or say about 500,000. Care is taken to see that the shrimps are stocked later than the *Chanos* to avoid predation.

As in the case of *Chanos* the ponds are stocked during the cooler part of the day and the conditions of the water in the jar are first approximated to those of the pond water to be stocked. After stocking the nurseries, little care is needed and rearing is limited to occasional renewal of the pond water, maintaining algal growth in the pond or given artificial feed in the form of rice bran.

With proper care and enough food for a period from one to two months the sugpo attain a size at which they may be transplanted from the nurseries to the bigger rearing ponds. Some difficulty is encountered in effecting such transfer because they burrow in the soft, muddy bottom. Two methods of transplanting are generally adopted, namely (a) trapping and (b) draining.

In the first case, shrimp traps made of bamboo screens or 'baklad' are set in the pond bottom, utilizing the same principles used in trapping fish in wild waters. There is a guide screen or leader, a forechamber and a catching chamber or cod end. Because of the non-gregarious nature of the shrimps and their burrowing habits, only a fraction of the stock can be caught by this method so that in order to effect a total catch the pond is drained slowly, allowing the shrimps to seek shelter in the deeper portions of the ponds. Once this stock has become concentrated in the deeper areas they are then gathered by hand for transfer to the bigger rearing ponds.

When the young sugpo are sufficiently advanced and are big enough to escape from their enemies, they are stocked in the rearing ponds regardless of the time of day or the condition of the ponds. Although better quality sugpo may be produced when cultured alone by themselves, the general prac-

tice is to raise them with *Chanos* inasmuch as these two species are compatible. About 10,000 sugpo may be stocked per hectare of rearing pond.

Not much care is given to the sugpo under cultivation in the rearing ponds and with enough food they are expected to attain marketable size in the period raging from six months to one year.

Cropping.—Unlike bañgos which are easily caught by nets or confined by renewal or draining of the water, marketable sugpo are harder to catch. This is because the shrimp usually move around individually and are burrowing in habit. In fact, some loss occurs on account of this both during transplantation from one pond to another and when harvesting marketable sugpo from the rearing ponds, although several means are employed to minimize such losses. Methods of capture by hand, by bamboo traps, by nets and by draining, are described in the following paragraphs.

(a) *Bamboo screen traps.*—Varied types of screen traps are used in harvesting sugpo. These traps utilize the same principle as ordinary fish traps encountered throughout the Indo-Pacific region. Essentially, they consist of a guide screen or leader and a cod end or catching chamber. An example of one such trap is the *bakikong* as shown in Fig. 3. The leader of this trap consists of one or two bamboo screens staked and oriented perpendicularly or diagonally from the pond dike. This leads the shrimp to a fore chamber from which the shrimps are led into the cod end or catching chamber. These traps are specially effective during dark nights, particularly if there is water movement caused by renewal or draining. The catch is enhanced by installing a light in the catching chamber at night. The catches consist mostly of hipon suahe (*Penaeus canaliculatus*). They may also include sugpo if present but rarely 'hipon puti' (*P. indicus*).

Another type of bamboo screen trap is the *paabang* (Fig. 4). This is set so as to intercept the shrimp at some narrow gap in the fishpond system. It consists essentially of the catching chamber which is centrally and posteriorly located and two wings to screen the water passage. These traps are more effective during dark nights and when strong currents of water can be made to flow through the passage

FIGURE 3.—The bakikong type of bamboo screen shrimp trap.

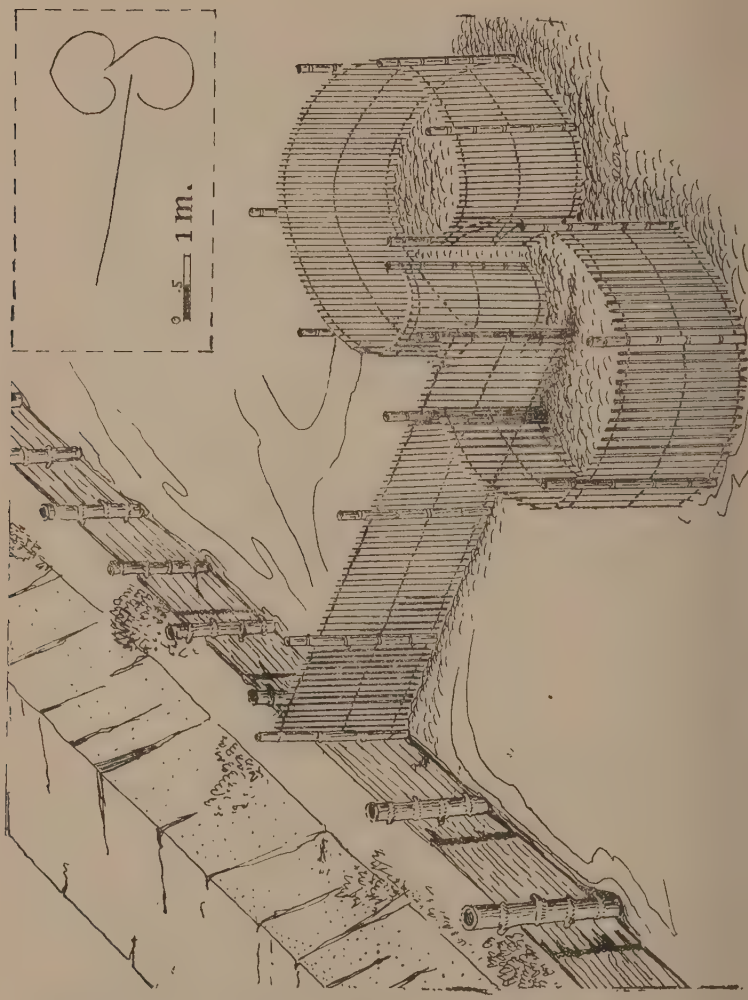


FIGURE 4.—The paabang type of bamboo screen shrimp trap.

where they are set. The main catch may be *P. canaliculatus* and possibly *P. monodon* if present, but rarely *P. indicus*.

A third type of bamboo screen trap is called aguila. This is a modification of the bakikong consisting essentially of a leader which is comparatively longer than that used in the bakikong and two chambers strategically located at both sides at the end of the leader as shown in Fig. 5. It is set in the deepest portion of the pond and is intended principally for catching *P. indicus*, although the catch may also include *P. monodon* if present. Although the catch is limited, it is more or less continuous regardless of the time of day or night, or whether the flow is regulated or not.

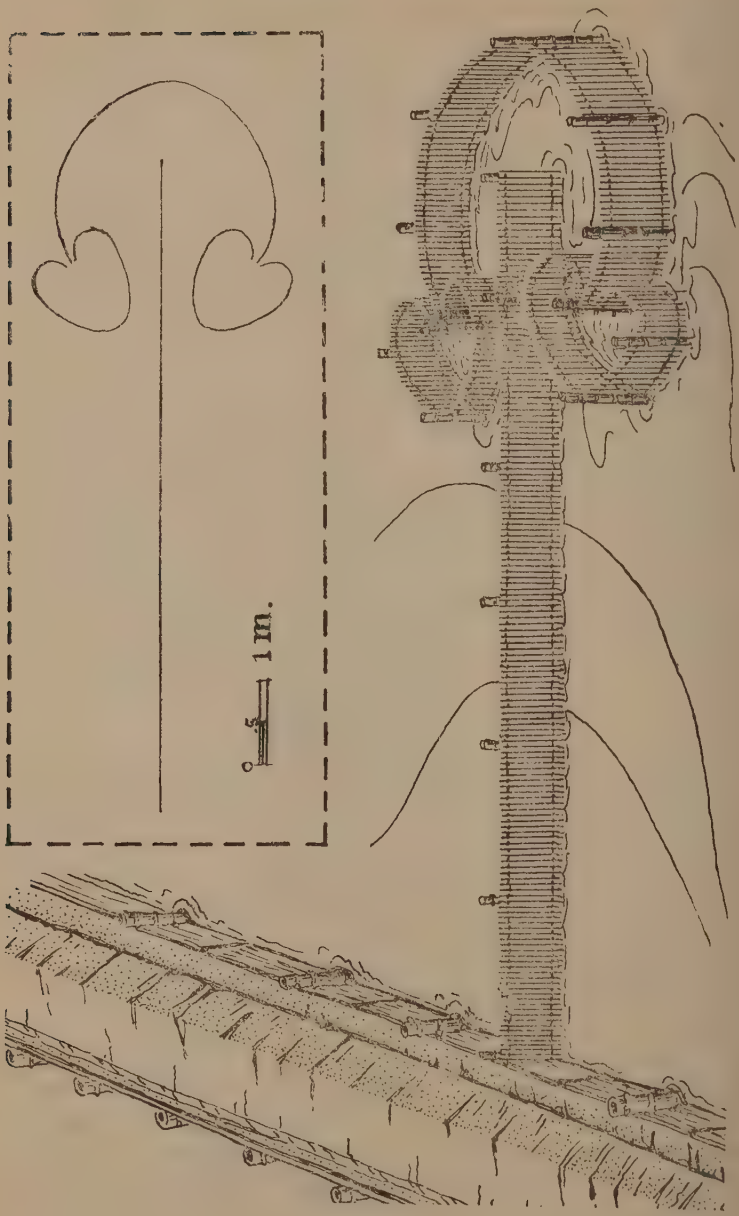
(b) *Net traps*.—A bag net of coarse cotton twine mounted on a wooden frame fitting into special grooves in the gate has come into general use in the cropping of shrimps in ponds. This net is called the lumpot. It is a sort of bag net tapering to an open end which is closed at will by tying with a piece of string and is usually set at the main water control gate, the water being previously raised to the maximum height at high tide. Thereafter, at sundown the water is allowed to go out with great force. The current carries the shrimps to the end of the bag where they are collected from time to time by a man stationed on a dugout canoe.

PROBLEMS OF SUGPO CULTIVATION

Sugpo cultivation, although very promising is beset with innumerable problems which need to be solved in order to put this industry on a sound scientific basis and make it a lucrative investment. Some of the problems encountered in this industry are difficulty of cropping; real or apparent low rate of survival under cultivation; and uncertain and limited supply of stocking material.

1. *Difficulty of cropping sugpo*.—Under cultivation, sugpo is cropped twice, i.e., at time of transplantation in accumulating a reasonable crop and in effecting a total catch. This may be attributed to the nongregarious habits of the shrimps. Hence, effective methods of capture have to be evolved.

2. *Low rate of survival*.—The amount of marketable sugpo recovered from ponds where they were previously stocked has been found to be very low. The estimated rate survival in ponds ranges from 10 per cent to 50 per cent. This may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be due to predators, natural mortality or the non-recovery of those shrimps which bury themselves in the soft, muddy bottom.

3. *Uncertain and limited supply.*—Perhaps the most important factor limiting the production of sugpo in ponds is the uncertain and limited supply of the juveniles for stocking purpose. The season for catching sugpo fry varies from year to year and the supply fluctuates considerably. There has been no systematic survey of actual and potential fry grounds except in places where they are incidentally found with the bañgos fry. Even if there is a supply of fry, the price is often exorbitant and the tiny needle-life fry costs from two to six centavos each where *Chanos* fry may cost 0.2 centavos a-piece Around the Manila Bay area most of the tidal creeks produce a limited supply of sugpo fry each year, and the towns bordering the Bacoor Cove along the Cavite Coast constitute a regular source of supply of sugpo fry to the fishponds in this area where the fry catching has developed into a special trade.

LAYOUT, CONSTRUCTION AND MANAGEMENT OF A 'SUGPO' POND PROJECT

A sugpo pond project can be established at any suitable place where adequate stocking material is available. For instance, a 10-hectare swampy area along a tidal stream, if falling within the tidal range and more or less level, with good clay loam or sandy clay loam soil and moderately clear of vegetation may be utilized. The area may be enclosed (Fig. 6) by strong main dikes high enough to keep off tidal water and flooding by freshets.

A concrete main water control gate (Mg) of double-opening type may be provided at a point easily accessible to the main portion. This may open to a head pond (hp) which should be the deepest portion of the system. This pond should lead to two secondary gate (sg) which in turn lead to the two rearing ponds (rp) and there will be a water control system leading to the nursery catching ponds.

The nursery unit, one hectare in area, should be located immediately in front of the head pond, away from the main water control gate and it should be shallower than the rearing ponds.

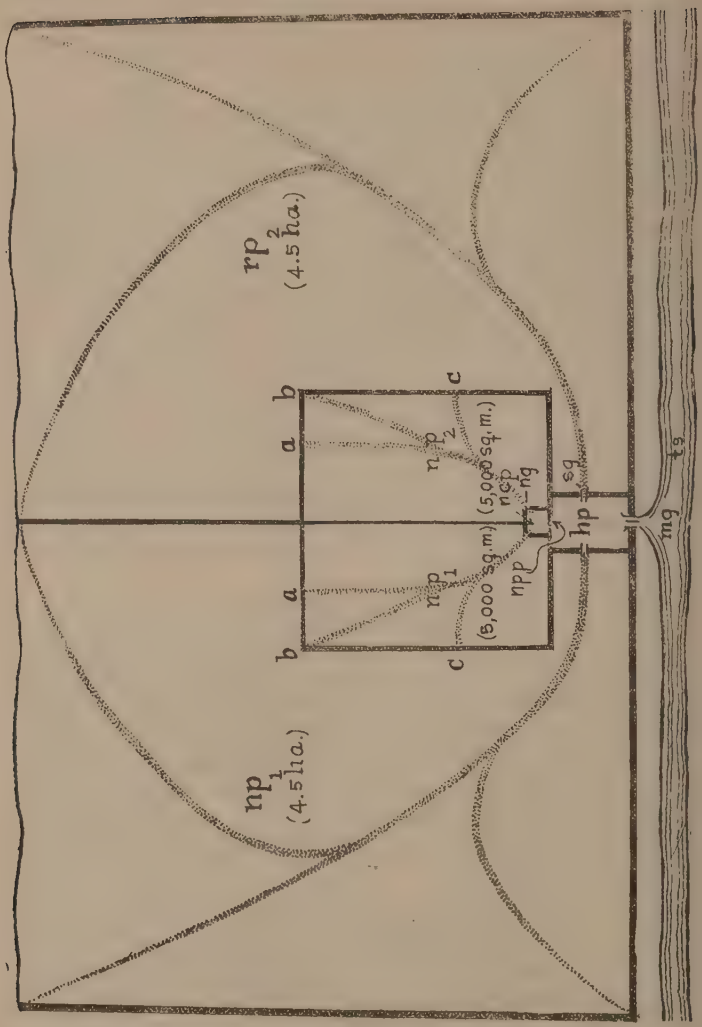

FIGURE 6.—Model layout of a 10-hectare *Penaeus* pond project.

A secondary dike, constructed in line with the main water control gate, would bisect the main area into two main parts, each with a large rearing pond and a nursery catching pond. Such a layout is deemed very convenient for transplanting the stock because the growing sugpo from each nursery can be easily transplanted by simply breaking or opening the dike to the adjacent rearing pond. At the outset, the entire fishpond system should be so leveled that the bottom will gradually slope from the periphery of the pond system to the head pond and the main water control gate. Then a system of special depressions or canals are constructed in each nursery and rearing pond running from the periphery towards the nursery and secondary, gates respectively, as indicated in Fig. 6, so as to facilitate harvesting.

Once established, the unit may conveniently be stocked with sugpo from 300,000 to 500,000 fry per crop, first in the nursery ponds for a period of one to two months for subsequent release in the rearing ponds. Of these fry, about 20 per cent may be expected to survive, leaving an expected crop of about 100,000, marketable shrimp equivalent to about 5,000 kg. valued at ₱15,000 (based on a wholesale price of ₱3.00 per kg.). Two crops a year, 3 crops in two years or one crop a year may be reared.

The desirable food organisms may be developed in the ponds by proper management. While this plan has been deduced from observations of a mixed culture of sugpo and milkfish, such a plan could be adopted in any expirement to find the possibility of pure culture of *Penaeus*. At present, a few of the more progressive *Chanos* fishpond growers in the Philippines are actually practising this system to a limited extent.

SUMMARY AND RECOMMENDATIONS

1. The cultivation of the sugpo in estuarine fishponds in the Philippines either as pure culture or in combination with *Chanos* is found to be a lucrative investment.

2. In order to minimize the losses due to the difficulty of collecting all the growing sugpo in the nurseries, it is recommended that the nursery ponds should be located adjacent to and at a slightly higher level than the rearing ponds where the sugpo are to be grown to marketable size. In this way, transplantation is effected by simply making a cut in the dike

between the nursery and rearing pond where the sugpo spread without the necessity of handling them.

3. Observations made during limited periods on the rate of growth of the shrimp are recorded. Studies should be undertaken to find out suitable feed when the natural food is exhausted.

4. The low rate of survival may be due to predators as well as to the difficulty encountered in the total cropping of the stock. It is necessary to stock sugpo in ponds which have previously been cleaned, drained and dried so as to reduce the danger of predation to a minimum.

5. Proper pond layout and construction may also eliminate the cumbersome methods of collecting and transplanting the stock. Studies should also be made to develop appliances to facilitate harvesting such as are used in shrimp capture from natural waters.

6. The most important factor that may limit the development of this promising industry is the uncertain and limited supply of the stocking material. A nationwide survey should be made to determine sugpo fry grounds and seasons as well as the feasible methods for their capture.

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FIGS. 1. The fry of sugpo, *Penaeus monodon.*
2. A full grown sugpo, *Penaeus monodon.*
3. The bakikong type of bamboo screen shrimp trap.
4. The paabang type of bamboo screen shrimp trap.
5. The aguila type of bamboo screen shrimp trap.
6. Model layout of a 10-hectare *Penaeus* pond project.

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STUDIES ON THE BLEACHING AND UTILIZATION OF THE SEAWEED "GULAMAN-DAGAT" (*GRACILARIA CONFERVOIDES*)[1]

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The annual occurence of "gulaman-dagat" seaweed (*Gracilaria confervoides*) in Philippine marine waters, especially along the shallow shores of Manila Bay, was first reported by Seale in 1911. The heavy season of this particular seaweed begins from January to the latter part of June every year. The report of Collado (1926)[2] on the nutritive properties of seaweeds, mentioned gulaman-dagat as a possible source of commercial agar and food as well. The amount of gulaman-dagat, found annually along the shallow shores of Manila Bay is enough to supply a home industry for bleaching and drying the seaweed for commercial purposes.

During the Japanese occupation in World War II, gulaman-dagat was used extensively as food in the form of salad and dessert, a kind of preparation similar to various recipes made out of imported commercial agar. Likewise, De Leon, *et al.* (1947), reported that gulaman-dagat is definitely an ideal source of commercial agar. Also in 1951, Kojiman claimed that the quality of agar prepared from *Gracilaria confervoides* is superior to others, and even exceeds the standard specified by the United States Pharmacopeia. A year later, Sulit, *et al.* (1952), mentioned gulaman-dagat, among other seaweeds, as a potential source of commercial agar. However, in spite of the aforementioned properties of this particular marine plant product, there is no move whatsoever in utilizing it in the manufacture of agar in the Philippines. The main reason, perhaps, is the high cost of producing this important commodity in this country as compared with other nations that can utilize the natural cold winter in freezing the solidified agar extract. One of the methods used in the manufacture of dried agar requires freezing temperature to freeze the

[1] Presented at the Indo Pacific Fish Council Meeting, 1961.
[2] Numbers in parentheses refer to references cited.

agar extract, so that drying is easily accomplished outdoor in a comparatively short period.

Under Philippine conditions, the authors advocate the direct utilization of the bleached dried gulaman-dagat in the preparation of various food products, purposely to create a home industry project in regions where this seaweed is plentiful. Bleaching and drying of the seaweeds may create a community home industry in many fishing villages throughout the Philippines. In this manner, importation of commercial agar may be reduced.

The usual practice of bleaching and drying gulaman-dagat seaweed under direct sunlight takes at least three days.

The present study was undertaken to find out the best and quickest means of bleaching gulaman-dagat by chemical methods and the utility of the product.

Gathering the seaweed.—Gathering the seaweed along the shallow shores of Manila Bay usually starts in the early morning when the tide is low. It is estimated that at the peak of the season, no less than 1,000 tiklis [3] of seaweed is harvested daily. Each tiklis has an average net weight of thirty-five kilograms of seaweed, and is being sold at prices ranging from ten to twenty-five centavos per tiklis, the price depending on the distance or place of destination.

Manual raking of the seaweed is a slow process and can operate only at a depth under one fathom. To increase the amount of harvest per man hour, an improvised rake is often attached to an outboard motor. This also enable harvesting to cover deeper areas even beyond one fathom. A collector with a bamboo basket goes around to each harvester and collects the seaweed, which is in turn deposited in a waiting "banca' or dugout. As soon as the banca is fully loaded, it is towed to transport the seaweed to prospective buyers, most of whom are fishpond operators who use it as supplementary feed for the "bangos', Chanos chanos (Forskal).

Bleaching the seaweed.—Several experiments were undertaken on bleaching the seaweed. Kojima (1951) used hypochlorides of calcium and sodium successfully in expediting bleaching. Potassium permanganate and hydrogen peroxide were also tried by him; but it took a longer time to accomplish the desired effect with these than with the hypochlorides.

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[3] A bamboo basket used for hauling fish and other agricultural products.

Treatment with saturated calcium oxide solution (calcium hydroxide.—In this study, a saturated solution of local material calcium oxide was used as a preliminary treatment in the sunbleaching of the seaweed. The seaweed was soaked in saturated solution of calcium oxide for several minutes until the final color of the seaweed was olive green. It was then spread on bamboo mattings and moistened occasionally to facilitate the bleaching. As soon as the seaweed was thoroughly bleached it was washed with fresh water and then dried in the sun. On drying, the product turned light brown. The whole process of bleaching and drying took 1½ days, depending upon the weather condition. Although calcium oxide aids in shortening the time of bleaching, the property of this chemical to harden plant tissues, toughens the seaweed, thereby making it hard to extract the agar from it completely.

Treatment with sodium hypochlorite.—The sodium hypochlorite used in this study was prepared in the laboratory by passing chlorine gas to a 5 per cent solution of sodium hydroxide. The solution thus prepared was too strong for bleaching the seaweed. Hence, it was diluted by using 1:10 up to 1:50 parts of water. The color of the seaweed was changed from dark green to olive or pea green. The treated seaweed was spread on bamboo mattings and occassionally moistened with water. As soon as bleached, the seaweed was washed with fresh water and then dried in the sun. With 1:10 and 1:50 dilutions, the length of time consumed was 20 minutes and 50 minutes, respectively. Although the length of time was shortened in converting the color of the seaweed to light green with the strong and 1:10 dilution of sodium hypochlorite, the gel strength of the agar extract prepared from the treated dried seaweed was found to be very low (Table 2). The 1:50 dilution of sodium hypochlorite proved to be the best as shown by the gel strength of the agar extract prepared from it. Table 2 shows that the gel strength is slightly higher in the experiment conducted without the addition of sulphuric acid.

Extraction of agar.—The extraction of agar from the bleached, dried seaweed presents another problem. The use of inorganic acid was advocated by Tressler and Lemon (1951). Kojima reported that at a pH of 6.0 brought about by the addition of sulphuric acid, greater yield of high quality agar is produced. In the present study, various amounts of one-

tenth normal sulphuric acid (1/10 NH_2SO_4) were used in the extraction of the agar.

For every 5-gram sample of the bleached, dried seaweed, 500 ml. of water, 5 ml. 10 ml. and 15 ml. of 1/10 NH_2SO_4 acid were added and the resulting pH determined (Table 1). All the experimental batches were boiled down to the same net weight before filtering into 100 ml. beakers set aside for use in the gel strength determination.

TABLE 1.—*Comparative hydrogen-ion concentration of the dried, bleached gulaman-dagat (Gracilaria confervoides) soaked in water containing various amounts of 1/10 NH_2SO_4.*

Treatment of seaweeds	Hydrogen-ion concentration according to amounts of acid used			
	0 ml. acid	5 ml. acid	10 ml. acid	15 ml. acid
	pH	pH	pH	pH
1. No treatment (control)	7.49	6.58	6.23	3.17
2. Saturated calcium hydroxide solution	7.42	6.66	5.82	3.18
3. Strong sodium hypochloride	7.46	6.58	5.75	3.23
4. Sodium hypochloride (1:10)	7.56	6.44	5.52	3.05
5. Sodium hypochloride (1:50)	7.20	6.41	5.60	3.27

Gel strength of solidified agar extracts.—In order to determine the quality of the extracted agar, the solidified agar extracts contained in 100 ml. beakers were tested for their gel strength in an improvised apparatus. The gel strength was measured in terms of milliliters of water registered in a 100 ml. burette attached to a balance. The cracking point made by the burette on the gel contained in the beaker constitutes the gel strength of the agar extracts (Table 2). The gel strength was seen to be poor, ranging from 2.40 to 8.10.

TABLE 2.—*Gel strength in milliliters of water of agar extracted from the dried bleached gulaman-dagat with various amounts of 1/10 NH_2SO_4.*

Treatment of seaweeds	Gel strength of extracted agar			
	0 ml. acid	5 ml. acid	10 ml. acid	15ml acid
1. No treatment (control)	17.1	13.8	14.32	20.2
2. Saturated calcium hydroxide solution	2.40	5.75	8.10	7.30
3. Strong sodium hypochlorite solution	10.20	7.10	3.30	3.10
4. Sodium hypochlorite (1:10)	15.80	8.50	5.30	5.60
5. Sodium hypochlorite (1:50)	27.70	25.20	26.40	26.70

Preparation of nutrient agar.—The imported bacto-agar is an expensive item in the preparation of nutrient agar solution. Bacto-agar was prepared by using the bleached, dried gulaman-dagat seaweed. To 14.25 grams of the bleached dried seaweed, 500 ml. of water was added, boiled for ten minutes and then filtered through cheesecloth. To every 200 ml. of the filtrate were added the following:

Peptone	1.25 grams
Bacto-beef extract	0.75 grams
Sodium chloride	2.00 grams

The mixture was heated to dissolve all the ingredients, the pH adjusted to 7.3, transferred to test tubes for purposes of plating and slants and then autoclaved for 15 minutes at 221°C. (15 lb. pressure). The nutrient agar thus prepared was satisfactory for plate count of bacteria in the microbiological laboratory.

Preparation of dried agar similar to imported commercial agar.—To 25 grams of bleached, dried gulaman-dagat, 875 ml. of water was added, and then it was acidified by adding 20 ml. of 1/10 NH_2SO_4 acid. The mixture was boiled for 30 minutes and then strained through cheesecloth. The residue was treated with 250 ml. of water; acidified with 10 ml. of sulphuric acid; heated to boiling; and then strained. After combining the first and second extracts, the mixture was allowed to solidify in moulds. The agar was then cut into strips of one half inch, and then set aside to freeze in the refrigerator. The next day the frozen agar was thawed and dried outdoors.

The prepared, dried agar was analyzed chemically and it compared well with the chemical analysis of the imported agar (Table 3).

TABLE 3.—*Comparative chemical analysis of various brands of agar.*

Proximate chemical composition	Gulaman-dagat agar	Korean agar	Japanese agar	American agar
1. Moisture	8.57	15.25	19.60	18.41
2. Ash	3.92	1.17	2.90	3.20
3. Protein (Nx 6.25)	5.28	6.25	4.23	1.12
4. Nitrogen free extract	0.17	0.20	1.08	0.19

Gulaman-dagat recipes.—A few preparations were made using directly the bleached, dried gulaman-dagat. The basic materials and the proportions of each are as follows: 25 grams of the seaweed; 4 cups of water; 3/4 cup of sugar and ½ cup of milk (coconut or cow's milk). Fruits and other ingredients were added to improve the flavor of the desserts. A panel of tasters favorably endorsed the wholesomeness of these preparations.

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SOME SEAWEEDS CONSUMED FRESH IN THE PHILIPPINES [1]

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ABSTRACT

Utilization of Seaweeds directly as human food is well-known in the Philippines. Among the species commonly used as food are *Acanthopora, Caulerpa, Codium, Gracilaria, Hydroclathrus, Laurencia, Porphyra* and *Sargassum*. The seaweeds are used raw or blanched mostly as salad vegetable.

INTRODUCTION

Like other Asians–the Japanese, Malayans and Chinese–the Filipinos, especially those from the coastal towns of the Philippines, are eaters of seaweeds. It is not uncommon for coastal inhabitants to be seen on the seashore during low tide collecting "vegetables of the sea", as one writer puts it.

It can be conjectured that the Ilocanos of Northern Philippines who are leading consumers of seaweeds spread the idea of seaweed-eating among the Pampangueños and Tagalogs of Central and Southern Luzon. Migrating Ilocanos to the coastal towns of Mindanao have also influenced the people of the locality to eat fresh seaweeds. The Bicolanos and Visayans of Central Philippines are also known to be consumers of fresh seaweeds.

Seaweeds are utilized by the Filipinos as food, medicinals and chemicals or fertilizers. Seaweeds are usually gathered, dried and transported from the coastal towns to Manila where they are processed into various forms as food or desserts especially the *Gracilaria* sp., chemicals-alginate products (*Sargassum sp.*) or medicinals and fertilizers (*Digena simplex*, etc.). Popularly known to have potential economic values are seaweeds belonging to the genera *Porphya, Gracilaria, Hypnea, Gelidium* and *Codium*.

[1] Presented at the Indo-Pacific Fish Council Meeting, 1961.

There is an undertermined quantity of seaweeds gathered and consumed directly as human food in the Philippines. It is commonly known that in markets of coastal towns–seaweeds are sold in the fresh state and prepared as salads or added to meat or fish preparations. Fresh seaweeds are generally rare in the markets of inland towns because of inadequate handling facilities.

There are twelve species of seaweeds presented in this paper which are known to be relished by the Filipinos since time immemorial. These are gathered in considerable quantities, sold and consumed in the fresh state.

The number of Philippine species not yet fully evaluated are no doubt still numerous. According to Dr. G. Velasquez (1953), "in the Philippines, the enormous amount of seaweeds existing along its coasts has not been fully evaluated, except in crude industries derived from them since early times. Accordingly, an opportunity to secure records of the geographical distribution of the local seaweeds and to facilitate their first hand identification is most timely". Only a complete taxonomic and comprehensive report on the economic values of fresh seaweeds will pave the way for the proper exploitation and utilization of these resources.

The species alphabetically listed herein are reported without emphasis on their taxonomic and ecological values. The scope of the general description is centered on their utilization as fresh. Whenever possible, chemical analysis, market price and distribution of seaweeds are included in the survey. Housewives were directly consulted regarding the methods of preparing fresh seaweeds for the table.

The writers hope that this paper will motivate or stir the arrested development of continuing researches on the economic values of seaweeds that thrive abundantly in Philippine waters.

ACANTHOPORA SPICIFERA (VAHL) BOERGESSEN VAR. ORIENTALIS J. G. AGARDH

Vernacular—"Culot"

Literature—Collado in Phil. Agri. 15 (1926) 129.

General distribution: Found in Cagayan Province, Zamboanga, Hundred Islands, Lingayen Gulf; usually collected along the reefs and seashore during low tide; abundant during June to October; gathered by hands; sold in the market in fresh form at 25 centavos per kilo.

Preparation for the table: Fresh seaweeds are washed to remove fresh water-stoned, sands, etc. Boiling water is then poured into the cleaned seaweeds and drained after one minute. Then chopped tomatoes, onions, ginger and patis (fermented fish sauce) are added to the seaweed. Vinegar or calamansi is sometimes used instead of tomatoes.

CAULERPA RACEMOSA (FORSKAL) WEBER—VAN BOSSE

Vernacular: "Lato" (Visayan region)

Literature: Velasquez in 1st Int. Seaweed Symp (1953) 100

General distribution: Found in Cebu, Catbalogan, Bicol, Zamboanga, Sulu, Pangasinan-cosmopolitan; collected along seashore and reefs during low tide; abundant from January to March; gathered by hands. Sold immediately after collection, otherwise, it will shrink and lose its quality. Market price 50 centavos per ganta.

Use: Eaten as a salad.

Preparation for the table: Seaweeds are cleaned of sand, debris and stones attached, then washed in fresh water. Chopped tomatoes and onions are added. Salt is also added to taste.

CAULERPA RACEMOSA VAR. UVIFERA (TURNER) WEBER—VAN BOSSE

Vernacular: "Ar-arusip"

Literature: Collado in Phil. Agri. 15 (1926) 129.

General distribution: Found in Cagayan, Ilocos Provinces, Lucap Bay, Hundred Islands, and in the Coastal regions of Mindanao. Collected along reefs and seashore during low tide; abundant during January to March; gathered by hand-picking. Sold in the fresh state—never sold in the dried form, for fifty centavos per ganta.

Use: Eaten as a salad.

Preparation for the table: Same as "Lato".

CAULERPA SERRULATA (FORSKAL) J. AGARDH

Vernacular: "Galgalacgac"

Literature: Collado in Phil. Agri. 15 (1926) 129.

General distribution: Found in Cagayan, Lucap Bay, Hundred Islands and coastal regions of Mindanao; collected along reefs and seashore —in the intertidal zones; abundant during May to August; gathered by hand-picking; sold only in fresh forms at 25 to 40 centavos per kilo. This species cannot be gathered in commercial quantities because of hazards in gathering them.

Use: Eaten as a salad.

Preparation for the table: Fresh seaweeds are washed to remove fresh water-stones, sands, etc. Boiling water is then poured into the

cleared seaweed and drained after one minute. Then chopped tomatoes, onions, ginger and patis (fermented fish sauce) are added to the seaweed. Vinegar or calamansi can be used instead of tomatoes.

CAULERPA SERTULARIODS (GMELIN) HOVE

Vernacular: "Salsalamagui".

Literature: Collado in Phil. Agri. 15 (1926) 129.

General Distribution: The same as the *racemosa* and *uvifera* species.

Preparation for the table: Same as the *racemosa* and *uvifera* species.

Use: Eaten as a salad.

CODIUM MUELLERI KUETZING

Vernacular: "Pokpoklo" (Ilocos provinces) "sinling sinling" (Leyte, Cebu, Bohol).

Literature: Collado in Phil. Agri. 15 (1926) 129.

General distribution: Found in Cagayan and Ilocos provinces, Lingayen Gulf, Leyte, Cebu, Bohol and parts of Central Luzon; collected along reefs and seashore during low tide; abundant during December to March; gathered by hand-picking; sold in baskets covered by wet sacks (otherwise seaweeds shrink when exposed) at fifty centavos per ganta. This species can be commercialized only when in season usually bartered with rice by the collectors. This species cannot be sold in dried form.

Use: Eaten as a salad.

Preparation for the table: Same as ar-arusip; can be prepared with or without tomatoes.

GRACILARIA CONFERVOIDES (LINNAEUS) GREVILLE

Vernacular: "gulaman", "guraman", "gulaman-dagat".

Literature: Blanco in Fl. Filip. (1937) 839; ed. 2 (1945), 580; ed. 3, 3 (1897) 290 (sub. non Fucus edulis).—Sulit *et al.* Chemical Studies and Utilization of Some Philippine Seaweeds IPFC Proceedings Sect. II, 4th Meeting, Phil. (1952) 165–170. Wells in Phil. Jour. Sci., A 11 (1917) 267 (sub. nom. gulaman-dagat). Wester, DANR Phil. Bull. 39 (1924) 21.—Velasquez in 1st Int. Seaw. Symp. (1953) 100.

General distribution: Found in Manila Bay, Zamboanga, Sulu and Cagayan; abundant from January to June; in Manila Bay, these seaweeds are gathered by using 'kalaykay" (rake) in areas from the shore to a water depth of one to one-half meters.

Fresh gulaman-dagat is sold as human food at 10 centavos to 20 centavos per "tumpok" or pile (800 grams to one kilo).

Although eaten, gulaman-dagat is generally used as food of fish (bañgos, *Chanos-chanos*) and utilized as an agar-agar source.

Gracilaria confervoides is being commercialized as food in the Philippines in the processed form and only a minimum quantity is consumed as fresh.

Use: Eaten as a salad.

Method of preparation: Fresh gulaman-dagat are washed free of dirt, sand and salt water. Then tomatoes, onions, ginger and salt is added to the raw or blanched seaweed.

GRACILARIA EUCHEUMOIDES HARVEY

Vernacular: "kawat-kawat"

Literature: Scale in Phil. Jour. Sci. D, 6 (1911).—Western in DANR Phil. Bull. 39 (1924) 21.

General distribution: Found in Lingayen Gulf and La Union; abundant from January to June; usually gathered by "kalaykay" (rake) at depths of one to two meters.

Use: Eaten as salad or added to fish preparations as vegetable.

Preparation for the table: As salad; seaweeds cleaned, blanched and tomatoes, onions, ginger and salt (to taste) added.

As vegetable: Seaweeds cleaned, then added to fish preparation recipes having soup.

HYDROCLATHRUS CLATHRATUS (BORY EX C.A. AGARDH) HOWE

Vernacular: "Balbalulang"

Literature: Blanco in Fl. Filip., ed 1 (1837); ed. 2 (1945) 582; ed. 3, 3 (1879) 262 (Sub. nom. Ulva reticulata).—Collado in Phil. Agri. 15 (1926). 129 (Sub. nom.) Hydroclathrus cancellatus—Velasquez in 1st Int. Seaweeds Symposium (1953) 100.

General distribution: Found in the Ilocos region, Cagayan and Pangasinan province; abundant during March to June; collected in sandy shores, bays and estuarine waters; usually gathered by hands in the margin of shores; sold in fresh from at 20 to 30 centavos per ganta.

Use: Eaten as a salad.

Preparation for the table: Seaweeds are washed thoroughly, then tomatoes, ginger and patis added. Ready to serve.

LAURENCIA PAPILLOSA (FORSKAL) GREVILLE

Vernacular: "tartariptip"

Literature: Miller et al in Hawaii Agri. Exp. St. Bull 98 (1946) 47, f. 14.2.

General distribution: Found in Cagayan, Zamboanga and Lingayen Gulf, abundant during June to October; collected during low tide; gathered by hand-picking found attached to rocks. Sold in fresh form at 25 to 30 centavos per kilo.

Use: Eaten as a salad.

Preparation for the table: Washed thoroughly and mashed tomatoes added. Ready to serve.

PORPHYRA SP.

Vernacular: "gamet"

Literature: Miller in Hawaii Agri. Exp. St., Bull 98 (1946) Sulit in IPFC Proceedings Section II, 4th Meeting, Quezon City, Phil. pp. 165–170.

General distribution: Found in Cagayan and Ilocos provinces, abundant from January to April; collected attached on cliffs and rocks along the shores affected by tides—never found in sandy shores, gathered by hand-picking.

Gamet is usually cultivated by setting twigs tied in bamboo poles stocked along shores at depths of 1–3 fathoms.

Twigs serve as anchor of gamet spores.

Use: Eaten as a salad.

Preparation for the table: Washed thoroughly, then add tomatoes, ginger and salt. Ready to serve.

They are also pressed into thin sheets and dried. In this form in sheets to rectangular, square or circular shapes.

When used for the table, the drier sheets are soaked in hot water, washed and drained thoroughly after which tomatoes, ginger and salt are added. Ready to serve.

SARGASSUM SILIQUOSUM J. G. AGARDH

Vernacular: "Aragan"

Literature: Seale in Phil. Jour. Sci. D, 6 (1911) 309—Webster in DANR, Phil. Bull. 39 (1925) 21.—Collado in Phil. Agri. 15 (1926) 129.

General distribution: Found in the Ilocos provinces; abundant from January to June; collected in shallow depths near the shore; gathered manually; sold in fresh forms at 30 to 40 centavos per kilo.

Use: Eaten as a salad and sometimes added to fish preparations as a vegetable.

Preparation for the table: As a salad-same as other salad preparations, as "vegetable" cleaned and cut into pieces, then added to the hot fish preparation with soup.

TABLE 1.—*Chemical analysis of some Philippine seaweeds consumed fresh.*

Scientific names	Moisture per cent	Ash per cent	Protein per cent
1. *Codium* sp.	93.59	2.94	0.15
2. *Gracilaria* sp.	7.12	31.12	12.81
3. *Hydroclathrus* sp.	10.54		10.40
4. *Laurencia* sp.	12.71	22.77	8.14
5. *Porphyra* sp.	35.71	15.70	12.56
6. *Sargassum* sp.	39.41	24.33	2.91

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EFFECTIVENESS OF BIOSTAT (OXYTETRACYCLINE HYDROCHLORIDE) IN MAINTAINING THE FRESHNESS OF "HASA-HASA" (*RASTRELLIGER BRACHYSOMUS*, BLEEKER)[1]

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ABSTRACT

Preliminary dipping of Hasa-hasa (*Rastrelliger brachysomus*, Bleeker) in a solution containing 50 parts per million of Biostat for 15 minutes was effective in prolonging the freshness of fish for 16 days. The fish preserved in Biostat ice alone were good for 11 days while those treated with ordinary ice lasted for 7 days. The fish used in this experiment were purchased from a local market center and the fish were not in a very fresh state. Effectiveness of Biostat in prolonging the freshness of fish can be accurately determined if the experiment is conducted on fish caught right in the fishing grounds.

INTRODUCTION

In tropical countries like the Philippines where the warm climate favors the growth of spoilage bacteria, the problems of marketing highly perishable food like fish demands immediate consideration. The yearly occurrence of fish poisoning is rampant in market centers which are far from the fishing grounds to the detriment of public consumers and the fishing industry as a whole. The City of Manila is much affected by this wave of fish poisoning, especially during the summer months when the high temperature favors bacterial spoilage.

In view of the aforementioned circumstances, the common methods of fish preservation in the Philippines are by drying and salting because they are the most economical and practical ways of inhibiting temporarily fish spoilage.

Recently, a new method of prolonging the freshness of fish was discovered by the use of small amounts of antibiotics, ranging from 1 to 100 ppm. based on the kind of material to be treated. In this connection, this study was conducted to determine the effect of the antibiotic (Biostat) in the preservation of fresh fish.

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[1] Presented at the Indo-Pacific Fish Council Meeting, 1961.

MATERIALS

The Biostat used in this experiment was supplied by the Belman Drug Corporation, a local representative of an American firm, Chas. Pfizer & Co., Inc. Realizing the benefit that Biostat could lend to the Philippine fishing industry, the Bureau of Fisheries, through its Microbiology Laboratory at Dagatdagatan Research Station at Malabon, Rizal, undertook the study to determine the effect of Biostat in prolonging the freshness of hasa-hasa (*Rastrelliger brachysomus,* Bleeker).

The fish were procured from a market center in Manila, which is quite far from the fishing ground where the fish were caught.

EXPERIMENTAL METHODS

1. *Preparation of Biostat ice.*—Biostat contains 8.5 percent oxytetracycline hydrochloride and to make 15 kilograms of ice requires 0.8823 grams of Biostat X–AI (special preparation of Biostat for making ice). The mixture was transferred into a deep freezer where it was converted into Biostat ice which was used in the experiments.

2. *Preservation of Hasa-hasa* (*Rastrelliger brachysomus,* Bleeker)—After washing the fish with clean potable water, the fish were dipped for 15 minutes in a solution containing 50 parts per million of Biostat GP, after which the fish were transferred to sterilized wooden boxes containing layers of crushed Biostat ice sufficient for the duration of the experiment.

3. *Preserving the fish with Biostat ice alone.*—A second batch of fish was directly transferred into another box without prior dipping into Biostat and then covered with Biostat ice.

4. *Preserving the fish with ordinary ice.*—The third batch of fish was packed in a box and covered with ordinary ice to serve as control.

All the three experimental batches of fish were stored with the corresponding methods of treatment and periodic observations were made on the physical changes and bacterial content of the fish.

5. *Bacterial colony count.*—To determine the extent of bacterial spoilage in these batches of fish, colony counts were determined at intervals of four (4) days.

Technical procedure used in total bacterial count.—The analysis for total bacterial count consists of enumerating the organisms or group of organisms capable of forming colonies produced by the different dilutions of samples grown in nutrients agar medium incubated at 37°C for 3 to 4 days.

The plates which contained 30 to 300 evenly distributed colonies were selected. All the colonies were counted with the aid of the Quebec colony counter.

The total count was estimated by multiplying the average number of colonies by the factor 63, which represents the area of the petri dish. This is then multiplied by the dilution factor to determine the number of micro-organisms present in the sample.

RESULTS AND DISCUSSION

The experiment revealed that the Biostat is quite effective prolonging the freshness of hasa-hasa by inhibiting the growth of micro-organisms which are responsible for the spoilage of fish.

TABLE 1.—*Fish iced without dipping in Biostat solution.*

Days in ice	Biostat in ice ppm	Micro-organisms per gram	Observation
Initial reading.	----------	1,286,500	Eyes bright, gills red, flesh firm, taste good.
2	0	163,000	Eyes dull, gills a little pale, flesh firm, taste good.
	5	126,000	Eyes bright, gills red, flesh firm taste good.
7	0	TNTC	Fish stale.
	5	622,000	Eyes dull, gills pale, flesh firm, taste good.
11	0	14,858,000	Fish stale.
	5	2,159,000	Eyes dull, gills pale, flesh a little soft, taste flat.
14	0	57,150,000	Stale.
		6,985,000	Fish showed signs of putrefaction.

Tables 1 and 2 show that the initial bacterial count of the fish was already high indicating that there was already bacterial action when the experiment was conducted. It is evident, however, that the Biostat was able to lower the bacterial count in the few succeeding days.

Table 2 reveals that preliminary dipping of the fish in a solution containing 50 parts per million of Biostat enhanced further the effectiveness of the antibiotic in prolonging the freshness of fish to 16 days. Those preserved with Biostat ice alone lasted for 11 days while the control group which was treated with ordinary ice lasted for 7 days only.

TABLE 2.—*Fish dipped in 50 p.p.m. Biostat Gp before storage.*

Days in ice	Biostatic in ice ppm	Micro-organisms per gram	Observation
Initial reading.	----	946,150	Eyes bright, gills red, flesh firm taste good.
1	0	946,150	Eyes bright, gills turned a little, pale, flesh firm, taste good.
	5	334,805	Eyes bright, gills red, flesh firm taste good.
2	0	480,050	Eyes dull, gills pale, flesh firm, taste good.
	5	228,000	Eyes bright, gills red, flesh firm taste good.
6	0	385.750	Fish showed signs of putrefatcion
	5	234,250	Eyes bright, gills pale, flesh firm taste good.
9	0	1,900,900	Fish putrid.
	5	85,000	yes, dull, gills pale, flesh firm,
13	0	8,255,000	Fish putrid.
	5	357,505	Taste flat.
16	0	TNTC	Putrid
	5	1,236,500	Taste flat.
19	5	TNTC	Showed signs of deterioration

Although the fish used in this study were brought several days after capture, the effect of Biostat to prolong their preservation is significant. In this connection, a much better method of determining the efficacy of Biostat to prolong the freshness of fish can be done by conducting the experiment right in the fishing grounds so that the Biostat treatment may be applied with newly captured fresh fish.

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PRAWN FISHERIES OF THE PHILIPPINES[1]

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Five Text Figures

The present report aims at listing the major species of prawns in the Philippines and describes the methods used in catching them including details of fishing grounds, and catch statistics.

Several species of prawns, along with other crustaceans such as lobsters, crabs and mysids provide fisheries of varying magnitude and value in the Philippines, though their commercial value is limited by selective demands of the market based largely on size, taste and availability.

The work so far done on the prawns of the Philippines has mostly been on the systematics of some of the most common species. Some of the reported species have been worked out by naturalists outside the Philippines on materials collected and deposited in foreign museums. Professor Eulogio Estampador, former colleague of the writer in the Department of Zoology, University of the Philippines, and Mr. Guillermo J. Blanco of the Bureau of Fisheries, have contributed much to Philippine carcinology. Their works are good sources of information on Philippine crustacean decapods. Blanco and Arriola, Cowles, Villaluz and Villadolid, have also made useful contributions to the study of Philippine prawns.

Studies on the morphology and anatomy of Philippine crustaceans of certain important commercial species have since 1954 been undertaken in the post graduate school of the University of Santo Tomas under the advisership of the writer.

Among the commercially important prawns in the Philippines, *Penaeus monodon* Fabricius stands foremost. Small species of Palaemon and Palaemonetes also occur in abundance, often in big schools. Other species are: *Penaeus indicus* Milne-Edwards; *P. monodon* var. *manillensis* Villaluz-Arriola; *P. indicus* var. *longirostris* de Man; *P. anchoralis* Spence Bate; *P. rectacutus* Spence Bate; *P. affinis* Milne-Edwards; *P. canaliculatus* var. *japonicus* Spence Bate; *P. incisipes* Spence Bate;

[1] Presented at the Indo-Pacific Fish Council Meeting, 1961.

Palaemon lagdaoensis Blanco; *P. talaverae* Blanco; *P. carcinus* Fabricius; *P. philippinensis* Cowles; *P. sundaicus* Heller; *P. lanceifrons* Dana; *P. lanceifrons* var. *montalbanensis* Cowles; *P. jarvensis* Cowles; *P. lepidactylus* Hilgendorf; *P. latidactylus* Thallivitz; *P. esculentus* Thallivitz; *P. esculentus* Thallivits; *P. lar Fabricius* and *P. luzonensis* Blanco.

FISHING METHODS AND GEAR

The common Philippine methods for the capture of prawns are grouped into set impounding nets, mobile impounding nets, entangling nets, guiding barriers and miscellaneous traps.

I. *Set Impounding Nets*

1.1 *The bukatot and the diakos.*—The *bukatot* is made of regular twine net of one centimeter mesh used for the catching of penaeid shrimps and crabs, while the *diakos* is made of sinamay or abaca cloth for catching small Palaemonids. They are small seines, 4 fathoms or more long and 1–1½ fathoms deep with a pocket of from 3 to 5 fathoms and are placed in strategic places against the current inside tidal creeks or mouths of rivers, attached to a wooden or bamboo pole at either end. The float line is provided with regular floats, the sinker line with lead weights, touching the bottom. They are operated by by one or two men; the pocket is lifted up at half an hour intervals, and the catch is emptied into the banca or dugout. This is almost a continuous operation, the net being removed, washed and dried from time to time. The *tangab* a filler net used in some regions is another form of the bukatot, with a pocket but without wings (Fig. 1).

1.2 *Saplad*—This is a simple method of barricading the edge of mangrove swamp with sinamay or abaca cloth supported by several poles. At the middle of the net is an opening where a pocket called lumpot is attached where the shrimps are collected as the tide recedes. Mud or stones are piled up at both sides of the net. In the early days, the original *saplad* was not provided with the pocket and a great number of shrimps got stuck in the mud and could not be recovered. The lumpot or pocket is 5 meters long and is closed distally by a piece of twine. When it is full, it is lifted and emptied into a banca (Fig. 2).

FIGURE 1.—Bukatot—hoop net.

FIGURE 2.—Saplad—made of sinamay for catching shrimps.

2. *Mobile Impounding Nets*

2.1 *Cast net* (dala, ataraya, tabokol).—It is a conical universally known net, operated by one man and thrown over a school of shrimps or fish. It is heavily weighted around the base, and provided with a retrieving line attached to the apical portion. The size varies from a small, shore-operated net to a large one used in conjunction with a vinta, a sharp-keeled dugout with outriggers on both sides, propelled by a sail in deeper waters (Fig. 3).

2.2 *Push net or scissor-net* (sakag).—This is the most common gear used. It is operated by one man who pushes it on tidal creeks, rivers and shallow shores with a smooth sandy-muddy bottom. It is usually made of fine-meshed net mounted on a triangular frame of two bamboo poles bolted at an angle point where the two poles meet. The angle of the poles can be increased or decreased during operation. The distal ends of the two poles are fitted with a shoe-like device made of wood or coconut husk to facilitate the pushing operation. It is used more effectively during dark nights and during new moon (Fig. 4).

2.3 *Skimming net* (anod-sulong).—It is similar to the push net out operated in deeper waters from a small dugout, or raft. The net is attached to one side of the craft which is pushed along with paddle or pole, causing a skimming motion of the net (Fig. 5).

2.4 *Drive-in-net* (Surambaw).—Various forms of framed or unframed lift nets operated with a scareline.

2.5 *Lever net* (salambaw).—It is a large, rigidly framed lift-net mounted on a bamboo raft and fished by a dipping motion of a lever-like arrangement. It is mainly operated for mullet and other smaller fishes but it is also used for catching shrimps. There are slight modifications in form and operation.

2.6 *Drag nets.*—Among the pull of drag nets the Japanese *utase* (beam trawl) and the otter trawl are the most common ones used in many fishing grounds, particularly around Manila. It is mainly intended for fishes but is also used extensively for the crustacean fisheries. The otter trawl is gaining popularity among the successful trawlers nowadays in the Visayan fishing grounds. At present, there are more otter trawls registered than beam trawls.

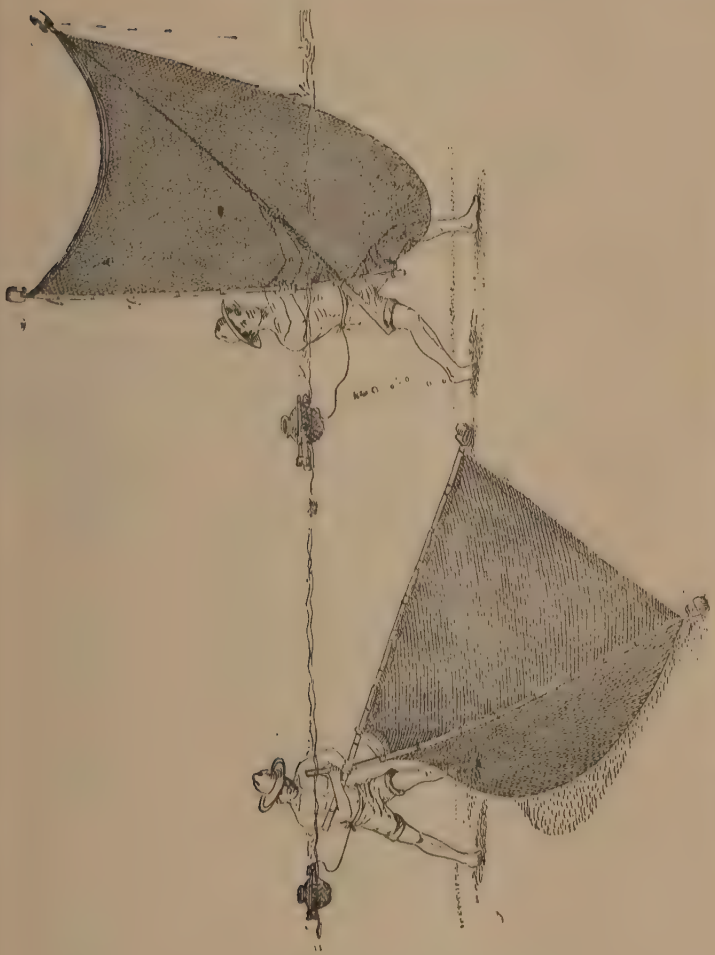

FIGURE 4.—Sakag (Tagalog)—a push net for catching shrimps.

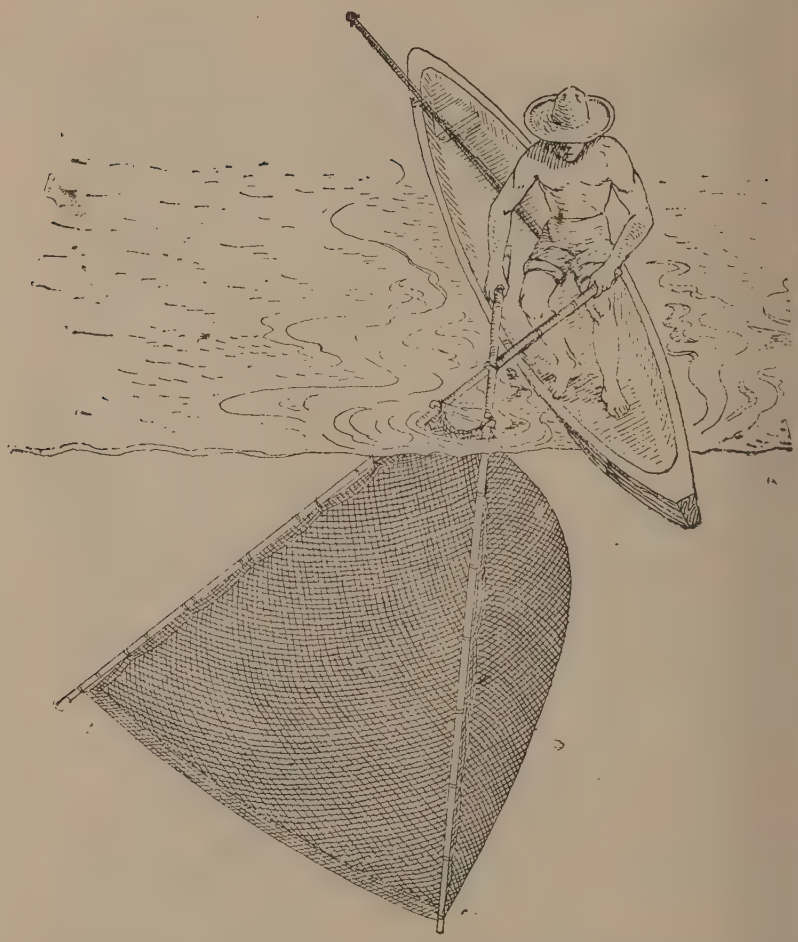

FIGURE 5.—Anod-sulong (Tagalog)—a skimming net for catching shrimps in waters beyond wading depths.

2.7 *Dip-net* (panalok).—It is a scoop made of non-textible webs in which the capture of shrimp and fish is effected by a baling or dipping action. This is used in scooping out the catch from the collecting pound of fish corrals.

2.8 *Cover pot* (salakab).—This is an entrapping device having a non-return valve. It is mainly used for catching mudfish (*Ophicaphalus striatus*), in rice fields and in inland bodies of fresh water during the day, but during dark nights it is used with torches and flash lights for catching crabs and *Penaeid* shrimp along the mouths of rivers, mangrove swamps and along the shallow coastline, particularly during low tide.

3. *Entangling Nets*

3.1 *Panti.*—This is a sort of gill net for shrimps and crabs. It is made from a No. 40 twine with a 1.5 inch mesh, 1.5 meter depth and a length of 55 meters. The float line is provided with rounded, light wooden floats of tuwi, a kind of light wood, and laced at intervals of half a meter. The lead line is provided with sinkers of 2 centimeters diameter at intervals of one meter. The net is usually dyed with extracts of bakawan bark. At least a dozen units of this net are joined together during fishing operation. The net is paid out in a semi-circle, starting from a buoyed anchor with the aid of a motorized boat. After paying out the net, the boat goes around facing the concave portion of the net, and with the noise of the engine the shrimps and the fishes are driven out the net and are gilled through the meshes. After this operation the men in the boat pull up the other end of the net and haul it on board. The operation is repeated continuously from 4 to 10 a.m. After the operation, the entire net is removed, washed and dried in preparation for the following day's operations.

4. *Miscellaneous Fishing Devices*

4.1 *Fish shelters* (sapatan)—They are anchored or suspended bunches of grass or weeds, which offer refuge for shrimps, and from where they are captured by devices operated in different ways. When the sapatan is anchored or submerged in shallower waters, bamboo matting (banata) is used to surround the fish shelter be-

fore the shrimps are bailed out. When it is suspended in deeper waters, a dip net made of sinamay may be used in catching the shrimps. Finely woven baskets may be used in place of the dip net. The sapatan is similar to some extent to the panugpo, a fish shelter for catching young shrimps and various other fish fry, in which bundles of grass or weeds are suspended to a long line of rattan or rope at regular intervals. The young of *Penaeus monodon,* locally known as sugpo, take refuge in the bundles and are caught from July to October in places around Manila.

4.2 The *bonbon fish shelter* should not be mistaken for the panugpo which is also known as "*bonbon*" by some fishermen. The bonbon is composed of brush piles at strategic places where shrimps and fishes take refuge. After some time, the brush piles are surrounded by bamboo matting and then removed before catching the shrimps and fishes with dip net or other device.

4.3 The *lawiswis* is a gear composed of an ordinary dugout with an outrigger on one side and finely woven bamboo matting (*banata*) on the other side which in shallow waters prevents the shrimps and fish from passing underneath the boat but scares them into the moving dugout.

5. *Guiding Barriers*

The fish corral (baklad or bunsod)—is made of a finely woven bamboo matting (banata) usually planted in shallow waters for catching shrimps. In the Iloilo fishpond, a small fish trap (*bunsod*) is planted inside the fishpond near the main gate for catching fish during high tide and shrimps when the water recedes during low tide, particularly at night. Similar gear is planted in tidal creeks inside mangrove swamps, mainly for catching shrimps. The small fish corral (*tankub*) also used in Iloilo fishponds has one impounding chamber (bolsa) with wings, while those planted in tidal creeks inside mangrove swamps and other shallower places near the mouth of the river, lagoons, coves etc. have two compartments and wings (pikpik). The *palapad* is similar to the saplad (see 1.2) in operation except that instead of the sinamay or abaca cloth, bamboo matting is used. It may or may not have the impounding chamber. The

palapad is intended for catching bigger Penaeid shrimps and fishes, whereas, the saplad is for smaller ones and for the smaller species of Palaemonid shrimps. These gears are operated only during the new and full moon.

FISHING GROUNDS

The Palaemonids are usually found inside coves and bays, and at times in mangrove swamps during high tide. The neighborhood of Margosatubig in Zamboanga del Sur, and around Bato-bato and other places in the Sulu Archipelago are among the principal Palaemonid fishing grounds in the South. The penaeid shrimps are found practically all over the Philippines waters from the shallow mangrove swamps to the deeper grounds inside bays, gulfs, and seas.

CATCH STATISTICS

Table 1 represents the volume of penaeid shrimps gathered from the different fishing grounds from 1951 through 1953.

TABLE 1.—*Penaeid shrimp catches.*

Fishing Areas	Shrimps in kilograms		
	1951	1952	1953
Asid Gulf	14,772	19,873	16,089
Babuyan Channel			
Batangas Coast			126
Bohol Strait		345	1,860
Cadiz Coast			17,235
Capiz Coast	60	3,066	
Carigara Bay	31,770	27,300	50,817
Dumaran Channel	1,485		
Guimaras Strait	258,588	206,397	121,182
Honda Bay	1,740		
Lamon Bay		240	
Leyte Gulf	1,950	3,126	
Lingayen Gulf	7,353	8,484	12,219
Malampaya Sound	1,500	156,384	25,665
Manila Bay	308,733	176,355	280,272
Maqueda Bay	16,068	121,569	353,982
Panay Gulf			20,319
Ragay Gulf	76,272	50,526	2,961
Samar Sea	286,851	180,669	284,508
San Miguel Bay	17,448	38,927	100,788
Sibuyan Sea		210	4,425
Sulu Sea	23,556	22,578	33,603
Tayabas Bay	1,704	17,544	21,372
Visayan Sea	145,683	286,782	244,278
Total	1,195,533	1,311,375	1,618,371

Table 2 gives the yearly catch of Penaeid shrimps in kilograms from 1948 through 1953 by the licensed trawlers (commercial fishing vessels over the three tons gross capacity). Catches by gear other than the trawlers are not included in this Table for lack of statistical data.

TABLE 2.—*Trawl catches.*

Year	Penaeid shrimps in kilograms
1948	996,015
1949	877,448
1950	1,092,996
1951	1,195,533
1952	1,311,375
1953	1,618,371

It will be seen that from 1950 to 1953 there was a gradual increase in the catch of the penaeid shrimps, apparently due to the gradual increase in the number of registered trawlers during the period, as is seen in Table 2.

TABLE 3.—*Registered number of commercial fishing vessels using trawls.*

Kinds	1949	1950	1951	1952	1953
Beam trawl	166	157	131	56	51
Otter trawl	58	129	190	234	227
Total	244	286	321	290	278

There was a gradual increase in the number of trawlers from 1949 to 1951 followed by a decrease in 1952 and 1953. There was, however, a consistent increase of the catch of penaeid shrimps from 1949 to 1953.

The statistical records for the penaeid shrimps are, however, far from complete. Not all the penaeid shrimps caught by the trawlers were accurately reported, with the exception of those that were supervised and inspected by the Philippine Fisheries Commission personnel. The tendency on the part of fishermen is to report less in order to pay less fees. Shrimps caught by gear other than the trawlers were never reported.

Processing.—A good portion of the penaeid shrimps particularly those caught by the trawlers, are processed into the dried product known as *hebe*. They are boiled and salted and then partially sun-dried, after which, the exoskeletons are removed mechanically and the meat is further dried and packed for the market.

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ILLUSTRATIONS

TEXT FIGURES

FIGS. 1. Bukatot—hoop net.
2. Saplad—made of sinamay for catching bangos fry.
3. Dala (Tagalog)—cast net.
4. Sakag (Tagalog)—a push net for catching shrimps.
5. Anod-sulong (Tagalog)—a skimming net for catching shrimps in waters beyond wading depths.

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FISH HYDROLYZATES FROM COMMERCIAL PHILIPPINE SPECIES [1]

PART I. PRELIMINARY STUDIES ON HYDROLYZED FISH PROTEIN

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ONE TEXT FIGURE

ABSTRACT

Hydrolyzed fish protein was prepared from five species of common Philippine market fishes. The process followed has the advantage of converting any kind of fish flesh into hydrolyzed protein, a product which is best recommended for special diet therapy, as an important supplement to diets of convalescent patients and as medications to specific types of ulcer. Hydrolyzed fish protein also makes possible the utilization of cheap species of fish particularly those with low commercial value into high quality protein foods.

INTRODUCTION

Fish is a well-known source of protein but because fresh fish is not always available in some parts of the Philippines, there are prevalent cases of malnutrition due to protein deficiency in some sectors of the country. It has been recognized also that some diseases prevalent to patients in hospitals are caused by protein deficiency.

This situation necessitates the proper utilization of fish as a protein source. It will make available fish in processed and more nutritious form to people affected by malnutrition in hospitals or to those staying in rural areas.

REVIEW OF LITERATURE

Solubilized protein from fish was developed in Germany as a substitute for egg white known as Wiking Eiwess. An abstract from a report of the British Intelligence Objective Sub-Committee mentioned the use of such product on bakery goods, sugar confectionery, ice cream, mayonnaise, custard powder, pharmaceuticals, textiles and leather industries. Roy Allen

[1] Presented at the Indo Pacific Fish Coun. Meeting, 11 (II): 284–291.

(1955)[2] likewise states the use of hydrolyzed protein in treating specific types of ulcers such as duodenal and ventricular ulcers and as an important supplement to diets of convalescent patients.

Biological assays and studies however, should be carried out to define the deleterious effects of hydrolyzed protein, if any, and at the same time to measure the quality of such protein food for growth and maintenance. A. B. Morrison claimed that toxic products may be produced by reactions between fish solids and solvents; and solvent decomposition products or solvent impurities.

It is probable that latex from local fruits particularly the papaya can be used for enhancing the rate of hydrolysis of fish flesh. This may minimize whatever loss of essential nutrients that occur during the alkali and acid hydrolysis process. In this connection, Ngo-Ba-thanh (1953) mentioned good results when pineapple juice was used as a hastening agent which is similar to that of a proteolytic enzyme. In Mysore, India, they have conducted studies on hydrolysis of fish meat using papain to obtain hydrolyzates rich in peptone. It is claimed that papain has been used for hydrolysis because of its favorable properties of pH and temperature optima for activity. Chaldelin, *et al.* (1942) has shown that papain have outstanding value for liberating several of the B vitamins from their bond forms.

Information on the amino acid content of Philippine fish proteins is still very meager so that a phase of this project will be directed to the determination of amino acid make-up of fish proteins and their sources by chemical as well as by bio-assay studies.

Studies on the distribution of nitrogen have yet to be carried out to establish the percentages of the basic amino acids fraction in the fish proteins since the fish proteins vary in the manner in which they are broken down to their degradation products. A comparison of the amino acid make-up of the fish proteins and casein by paper chromatography is also being considered for future studies because fish proteins are claimed to compare favorably with standard casein. Deuel, *et al.* (1946) isolated proteins from mackerel, sardine and tuna and compared their nutritive value with casein. They found that these fish proteins are superior to casein.

[2] Numbers in parenthesis refer to references cited.

The objective of this project is to utilize commercial species of market fishes which are not very palatable in ordinary food preparation due to unpleasant taste and odor. With this project, such species would be better utilized as special protein supplement in diet therapy, thereby enhancing their commercial value. Fish in its processed form can also be adequately supplied to people in the rural areas not easily reached by fresh fish.

The scope of this paper is confined only to the preliminary studies on the preparation of hydrolyzed fish protein.

Studies dealing on the use of latex from local fruits as catalysts for hydrolysis; nitrogen distribution and amino acid make-up of the fish proteins under investigation; and the biological assays to measure the quality of such protein foods for growth and maintenance shall be presented in subsequent papers.

Some species of fish used in this project were purchased directly from the local market. Some were requested through fish dealers and some were available at Dagat-dagatan Salt-water Fishery Experimental Station of the Philippine Fisheries Commission at Malabon, Rizal (Fig. 1).

In the present investigation, a method similar to that reported by the British Intelligence Objectives Sub-Committee with some modifications is employed. The details given below represent the method used and found satisfactory by Mohanty and Roy (1955) for the preparation of fish proteins.

Fish muscle was filleted and uniformly shredded. The pieces were leached with 0.5 per cent acetic acid under reflux to 80°C for about 50 minutes. The soluble nitrogenous constituents were thus removed. The connective tissue was broken down and the ash content possible removed. The material was then washed in running water and pressed to reduce the water content. The oils and fat were extracted overnight from the press cake with 95 per cent alcohol. Excess solvent was completely removed in an oven at 70°C. The dried material was ground to a fine powder and then made soluble by hydrolyzing with aqueous alkali. To every 100 gm. of fish powder about 500 ml. of water and 5 gm. of caustic soda was added and hydrolyzed for about 2 hours at 80°C. When the substance was completely liquefied, it was neutralized with 10 per cent acetic acid. The neutralized liquid was spray dried to yield a cream and flour-like powder.

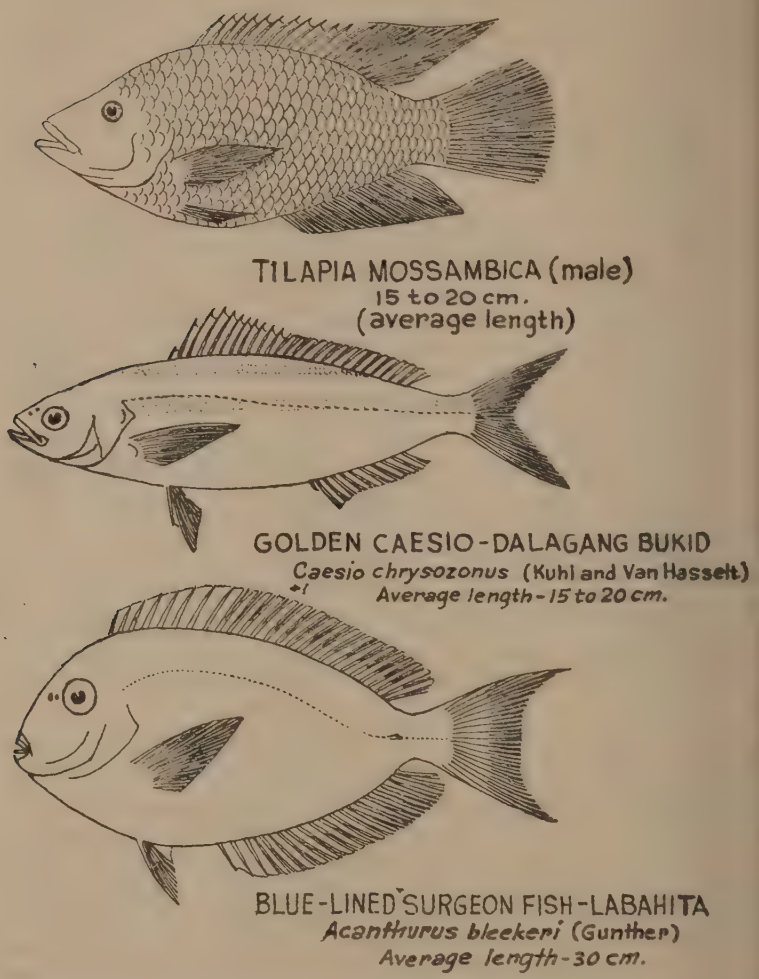
TILAPIA MOSSAMBICA (male)
15 to 20 cm.
(average length)
GOLDEN CAESIO - DALAGANG BUKID
Caesio chrysozonus (Kuhl and Van Hasselt)
Average length - 15 to 20 cm.
BLUE-LINED SURGEON FISH - LABAHITA
Acanthurus bleekeri (Gunther)
Average length - 30 cm.

FIG. 1.—The five commercial species of fish used in the preparation of fish hydrolyzates.

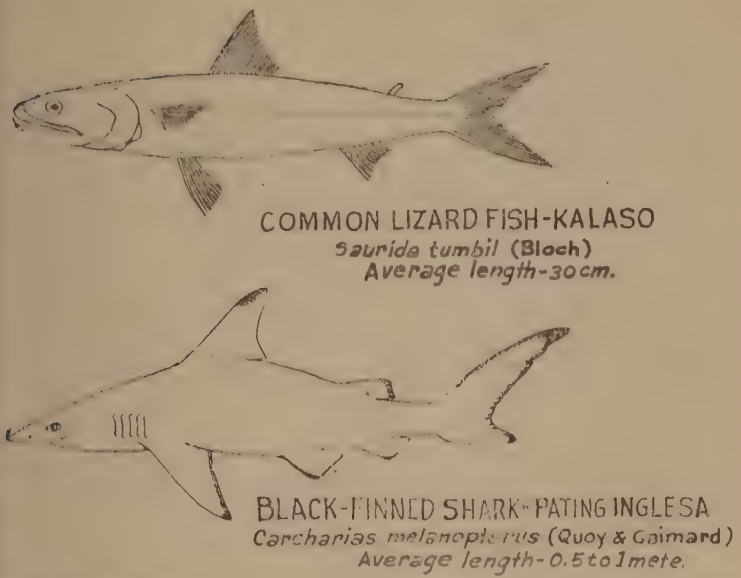

FIG. 1.—The five commercial species of fish used in the preparation of fish hydrolyzates.—(Continued)

Due to the inavailability of a spray dryer, the following procedure was followed:

One hundred grams of the powder was mixed with 500 ml. of 1 per cent sodium hydroxide and heated in a water bath for an hour at 70° to 80°C. This treatment resulted in a fairly good solution of the muscle powder in dilute alkali. This solution was filtered through a cotton plug. The filtrate was cooled to 50°C in order to facilitate the precipitation. The precipitation was carried out by the addition of dilute acetic acid (1 ml. of glacial acetic acid diluted to 100 ml. distilled water) to the filtrate. The solution was continuously stirred during precipitation until neutral. The supernatant liquid was removed on a Buchner funnel. The protein was washed twice with distilled water and finally dried at about 50°C.

Purification consisted of repeating the above procedure of dissolving the wet precipitate in the alkali solution and re-precipitation with acetic acid for two or three times.

RESULTS AND DISCUSSION

Table 1 shows the proximate chemical composition of the different species of fish utilized in the preparation of hydrolyzed protein.

TABLE 1.—*Proximate chemical composition of fish species.*

Local name	English name	Scientific name	Moisture per cent	Ash Per cent	Crude protein Nx6.25	Fat per cent
Tilapia	Tilapia	Tilapia mosambica	76.40	1.34	20.68	1.75
Dalagang bukid	Caesio	Caesio sp.	80.01	1.45	17.37	0.91
Kalaso	Lizard fish	Saurida tumbil	77.29	1.48	19.54	0.79
Pating	Shark	Carcharias melanopterus	76.29	0.51	21.25	2.36
Labahita	Surgeon	Acanthurus blee kari	79.77	1.14	19.19	0.43

The proteins of tilapia, caesio, lizard fish, shark and surgeon fish contain about 3 per cent nitrogen.

The proximate chemical analysis of fish protein obtained was carried out according to the method described in AOAC. Results of the analysis are presented in Table 2.

TABLE 2.—*Proximate chemical analysis of hydrolyzed protein.*

Fish protein	Moisture (per cent)	Ash (per ce	Nitrogen (per cent)
Gram per 100 grams of	dry sample		
Tilapia	9.63	8.52	14.68
Shark	8.95	0.53	13.27
Labahita	6.37	1.15	15.06
Dalagang-bukid	5.61	0.83	14.77
Kalaso	6.40	0.64	14.52

The creamish and flour-like fish protein powder obtained attains a more natural seashore odor than a fishy odor. It is soluble in water, hence may be easily assimilated. The product contains approximately 85 per cent protein.

A 10 per cent solution whips into a foam equivalent to natural egg white. The product is not coagulated by heat. Compared with other similar products, the keeping quality of hydrolyzed protein is better because it is in powdered form, with low fat content and can be easily vacuum-packed in bottles and polyethylene bags. Fish protein in its spray-dried form has a better appearance than ordinary fish flour. The protein content is higher than that contained in other foods such as raw or boiled eggs, cheese, roasted chicken, raw beef and fresh whole milk.

Its solubility in water with its high protein content makes it suitable for use as protein supplement in special diets in the form of soups, bakery goods, and as stabilizer in ice creams, mayonnaise and custard powder.

Table 3 shows the intensity scale followed in evaluating the odor and flavor description of the protein product.

TABLE 3.—*Intensity scale followed in evaluating the odor and flavor description of the protein product.*

)(	—	very weak
1	—	weak
2	—	medium
3	—	strong
4	—	very strong

Flavor profile.—According to the flavor profile evaluation illustrated in Table 4 the hydrolyzed product conforms to a more or less preferable standard. Since the non-hydrolyzed form is not soluble, a second stage in which the product was hydrolyzed, rendered it more assimilable.

TABLE 4.—*Odor and flavor descriptions of the two stages of the products obtained.*[a]

First Stage—Non-hydrolyzed product:	Intensity Description
Odor—seashore odor; feeding	) (
Flavor—dry; tasteless; like grains (or "feedy" like chicken eggs, chicken fed with fish meal)	) (
Aftertaste—seashore, fishing	) (
Second Stage—Hydrolyzed product:	
Odor—seashore odor	) (
Flavor—dry, tasteless	) (
Aftertaste—fishy	) (

[a] Tables 3 and 4 sum up the so-called flavor profile methods as formulated by Dr. Gisela Jellinek, organic chemist from Heidelberg, Germany (Fllavor Consultant Sensory Analysis).

CONCLUSION AND RECOMMENDATION

The hydrolyzed fish protein obtained from Philippine market fishes was soluble, creamish and a flour-like powder with a crude protein content of about 85 per cent with a yield of about 10 per cent of raw material.

The final product can be included in dietary food preparations of hospitals and also be incorporated in the food preparations of people in the rural areas to increase their protein intake.

The future studies such as the use of latex from local fruits as catalysts for hydrolysis; the nitrogen distribution and amino acid make-up of the fish proteins; and biological assays as mentioned for consideration in subsequent papers are therefore recommended to further evaluate the protein quantity and quality as well as the true nutritive values of the final product.

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ILLUSTRATION

TEXT FIGURE

FIG. 1. The five commercial species of fish used in the preparation of fish hydrolyzates.

PREPARATION OF 'GALONGONG' (*DECAPTERUS MACROSOMA*) FISH MEAL AND ITS NUTRITIVE VALUE[1]

By O. N. Gonzales, S. V. Bersamin and J. I. Sulit
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One Text Figure

The manufacture of fish meal from various species of fish of minor commercial importance can help reduce the amount of fish meal importation into this country. In view of the increasing poultry and livestock industries, our fish meal importation of 260,754 kilograms in 1949 was increased to 1,812,041 kilograms in 1953, showing an increase of approximately 700 per cent in a period of four years. In spite of this importation and the great need of fish meal, not much work has been done in the manufacture of this product in this country. This may be due to lack of practical knowledge of the technique in fish meal manufacture or of information on the utilization of the product.

Because of the high protein and low crude fibre content, fish meals have been known (Nelson 1951)[2] to be valuable in the feed of poultry and other animals. Petersen, *et al.* (1952) reported that with 5 per cent fish meal in the ration of poultry, the maximum hatchability was obtained. The old method of drying fish meal by direct flame process has been discouraged because high temperature lessens the nutritive value of the product. Pottenger, *et al.* (1935) claimed that drying of fish meal at high temperature destroys the most important essential aminoacids, namely, tyrosine, tryptophane and cystine. Clandinin (1949), revealed that fish meals dried in vacuum at 10 or 16 inches have very much higher nutritive value than those dried by the heat method of 220°F.

The aim of the present work has been to develop the heat methods of preparation of fish meal adaptable for home industry in fishing centres, and determine the comparative

[1] Presented at the Indo-Pacific Fish Council Meeting, 1955.
[2] Numbers in parentheses refer to references cited.

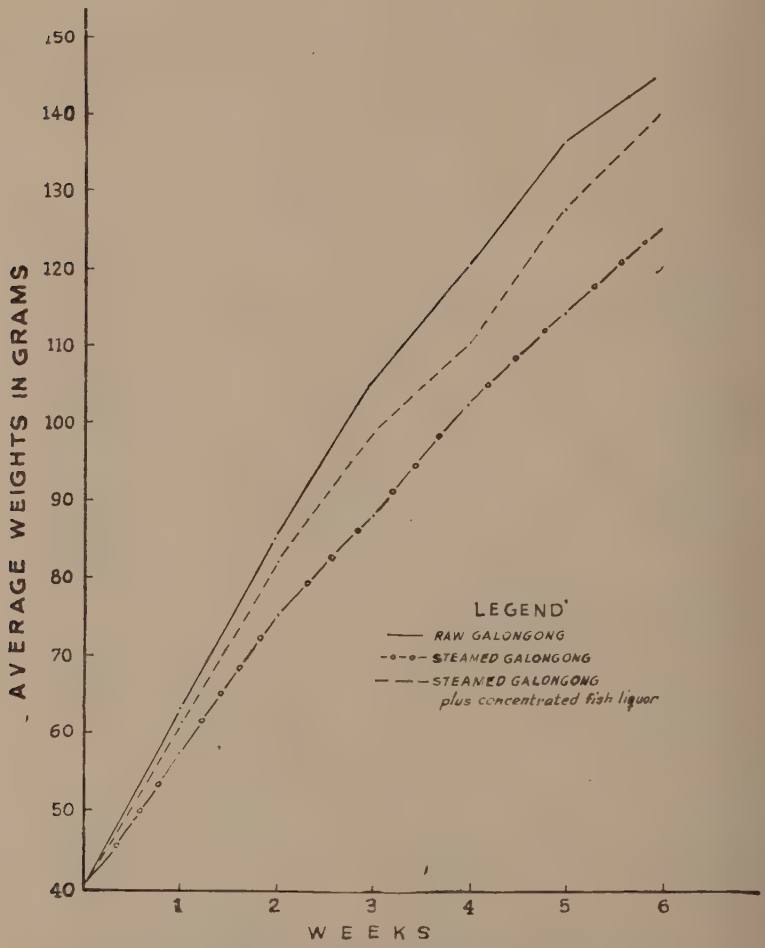

FIG. 1. AVERAGE WEEKLY WEIGHT OF RATS FED WITH DIFFERENT DIETS

nutritive value of the corresponding fish meals by means of chemical and bio-assay studies.

Preparation of fish meals.—The galongong (*Decapterus macrosoma*) was chosen because of its high protein and low fat content (Sulit, *et al.* 1953) and because of its abundance in many of the Philippine marine waters, being one of the cheapest kind of fish found in the market. Twelve kilograms of the fresh fish were divided into three parts of four kilograms each. The first portion was cut into small pieces and then dried directly at 45°–60°C. When thoroughly dried the product was ground, weighed and placed in an air-tight container. The second and third portions were steamed for thirty minutes, after which they were reduced to small pieces and then dried at 45°–60°C. When thoroughly dried the fish meal was ground, weighed and placed in air-tight containers.

Preparation of the concentrated fish liquor.—The expressed liquor resulting from the steaming process of the second set of galongong was concentrated to 50 per cent of its original volume to produce a thick syrup. This product is similar to the fish soluble concentrate which is known to contain the vitamin B_{12} and the growth promoting compound (Bohstedt, 1950; Singsen, 1952; Tiliman, *et al.* and Pensack, *et al.* 1949).

The fish meals and the concentrated fish liquor prepared according to the aforementioned methods were analyzed chemically for their protein, fat, carbohydrates (calculated by difference), ash and mineral content (Table 2). The value for growth studies of the products was determined by utilizing the biological method. The percentage (Table 1) yields of the products were also recorded.

Physical properties of the fish meals and concentrated fish liquor.—The color of fish meal prepared from raw galongong is slightly darker than that processed by the steam method. The former has a slight putrid odor, which could be attributed to the partial decomposition of the fish during the process of drying. The color of the fish meals prepared by the steam method is light brown and it exhibits a characteristic fishy odor. The physical appearance of the latter is very much better than the former.

The concentrated fish liquor obtained by dehydration is a thick syrup, dark brown in color and having the usual predominating fishy odor.

Chemical analysis.—As shown in Table 1, the percentage yield of fish meal prepared from raw galongong is 26.87 per cent as compared with 22.39 per cent in the steam-cooked product. The amount of concentrated fish liquor produced is 9.86 per cent.

TABLE 1.—*The percentage yield of fish meal and concentrated fish liquor.*

Products	Per cent
1. Raw fish meal galongong	26.87
2. Steamed fish meal galongong	22.39
3. Concentrated fish liquor	9.86

Table 2 shows the proximate chemical composition and mineral analysis of the fish meals and the concentrated fish liquor. The protein content of the two fish meals of galongong are extraordinarily high, considering the fact that there is still an ideal amount of 5 per cent moisture in the final products. The protein content of the prepared concentrated fish liquor is slightly lower. However, a similar product, the fish soluble concentrate, is known to contain the growth

TABLE 2.—*The proximate chemical composition and mineral content of galongong fish meals and the concentrated fish liquor.*

	Raw Galongong	Steamed Galongong	Concentraed fish liquor of galongong
	Per cent	*Per cent*	*Per cent*
Protein	74.17	75.04	70.08
Fats	6.74	9.54	2.21
Carbohydrates	.33	.08	.12
Ash	13.05	9.99	8.57
Moisture	5.26	5.35	19.02
Calcium	4.08	3.37	.39
Phosphorus	2.14	1.83	.67

promoting factor needed in the poultry and livestock industry (Petersen, *et al.* 1952). The calcium and phosphorus contents of the raw fish meal are slightly higher than those of the steam cooked fish meal.

Bio-assay.—Thirty albino rats of about the same weight were selected for the bio-assay. When the rats were about

28 to 30 days old, litter mates were divided into three groups of ten rats each, such that there would be a good distribution of males and females, and the total group weights would be about the same. The experimental diets were prepared so that the final composition contained 18 to 20 per cent protein derived from the fish meals and the added concentrated fish liquor in the amount of 2 per cent of the mixture or the diet (Tables 2 and 3).

The rats were placed individually in separate cages with raised screen bottoms provided with paper towels to prevent the loss of spilled food. Ordinary room temperature was maintained throughout the bio-assay period. Periodic weights were recorded and observations on the health or any abnormal developments of the rats were made daily.

Table 3 shows the composition of the experimental diets used. The fish meals and concentrated fish liquor constituted the major source of protein in feeding the experimental rats and water was given *ad libitum*.

TABLE 3.—*Composition of experimental diets using the corresponding amount of fish meals and concentrated fish liquor.*

	Group I	Group II	Group III
	Per cent	*Per cent*	*Per cent*
Corn starch	68	69	69
Lard	3	3	3
Sodium chloride	1	1	1
Calcium carbonate	2	2	2
Yeast	2	2	2
Cod liver oil	4 drops	4 drops	4 drops
Fish meal (raw galongong)	24	—	—
Fish meal (steamed galongong)	—	23	21
Concentrated galongong fish liquor	—	—	2

As shown in Table 4 and Figure 1, the average increase in weight of experimental rats fed with raw galongong fish meal is significantly high as evidenced by the weekly gain in weights. It is followed by the increase in weight of rats fed with steam-cooked galongong plus 2 per cent of the concentrated fish liquor. The third best were shown by rats fed with steam-cooked fish meal.

TABLE 4.—*Average weekly weight of rats fed with different diets mentioned in Table 3.*

No. of Rats	Protein Supplement	Initial Weights	Weekly Average Weights						Average increase in weight
			1	2	3	4	5	6	
		gm	*gm*	*gm*	*gm*	*gm*	*gm*	*gm*	
10	Raw galongong	41	63.4	85.6	106.4	120.8	138.4	147.7	107
10	Steamed galongong	41	58.9	75.1	89.0	100.9	114.3	127.2	86
10	Steam galongong plus 2% concentrated fish liquor	31	60.8	82.1	99.4	111.9	128.9	142.7	102

All the rats fed with the three kinds of fish meals showed no indication of abnormalities as they were all in good health, as shown by their active movements. All the experimental rats at the end of the experiments have well rounded and plumb bodies and significantly clear eyes.

DISCUSSION

Sulit, *et al.* (1953) reported that galongong contains approximately 72 per cent of edible portion. The present study revealed that in the manufacture of galongong fish meal, a yield of approximately 25 per cent was obtained.

Of the three kinds of fish meals prepared, raw galongong fish meal gave, as shown above, the highest rate of growth, followed by steamed galongong fish meal plus the concentrated fish liquor and thirdly, by the steamed galongong fish meal alone.

Because of the putrid smell of raw galongong fish meal, it is recommended that preliminary steaming of the fish be undertaken before drying. It is further recommended to add at least two per cent of the concentrated liquor to the fish meal to improve its nutritive food value.

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NOTICE

We regret to announce that due to circumstances beyond our control, the publication of The Philippine Journal of Fisheries has been delayed. The last issue published was Vol. 8, No. 1 (January–June, 1960). This issue covers the period July, 1960 to December, 1970 as Vol. 8, No. 2 (July, 1960 to December, 1970), to close the gap during the years that the semi-annual issues have not been published.